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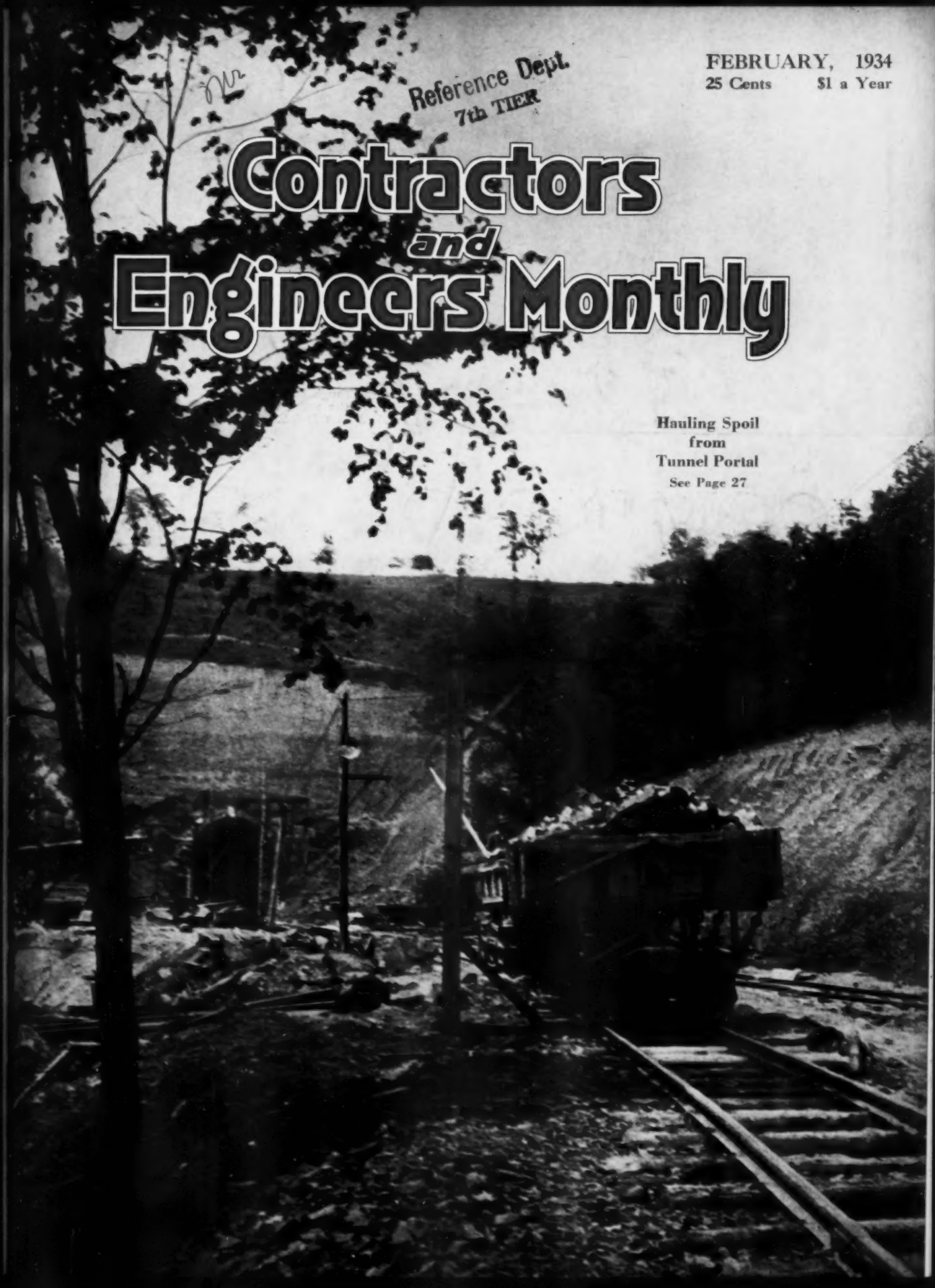
Contractors and Engineers Monthly



Hauling Spoil from Tunnel Portal

See Page 27

No job is too tough for a Galion Grader. Note the amount of dirt being handled on this job.

COMING OR GOING

It's a Galion Grader for a Tough Job

Anyway you look at it . . . wherever you go . . . you'll find that Galion Leaning-Wheel Graders are really giving constant day-in and day-out service. They take the toughest jobs and like them.

Galion Leaning Wheel Graders have a reputation for being well made . . . for giving unequaled performance . . . for making new records in yardage handled . . . and for having many exclusive operating advantages.

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Here's another view of a Galion Grader really going places and doing things.

The Galion Iron Works & Mfg. Co.

GALION, OHIO

Please mention CONTRACTORS AND ENGINEERS MONTHLY—it helps.

Industrial Railway Outfit Poured 1,400 Feet Per 12-Hour Day

Lampert & Lampert, Inc., of Oshkosh, Wis., Worked Two Crews Daily

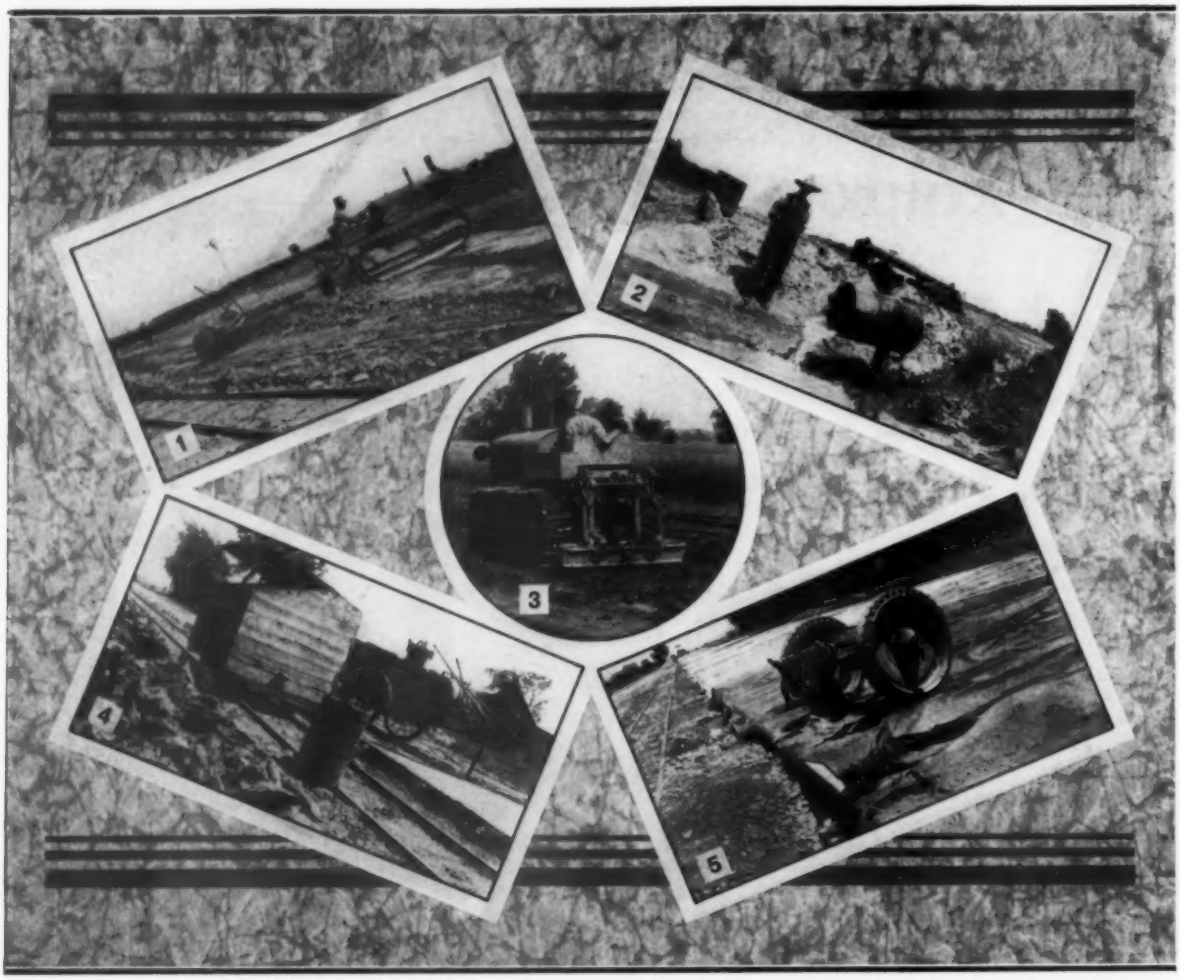
WITH no streams from which to secure the water for mixing the concrete and curing the pavement, Lampert & Lampert, Inc., on their 6.8-mile concrete paving project on U. S. Route 10 just west of Manitowoc, Wis., drove a 282-foot well with a 6-inch casing near the center of the job and put in an air-lift pump so that the water was delivered to a pool formed by enlarging the ditch alongside the grade. The separator for the air-lift was an oil drum set over the discharge of the well and then the water dropped into the ditch. At the other end of the 100-foot pool thus formed, a C. H. & E. triplex pump delivered the water through a line of 2½ and 2-inch pipe laid along the south side of the grade. A Sullivan portable compressor provided the air for the well pump. An Oxweld-Acetylene carbic flare was kept at the pump in case of any need of night operation or emergency work on the well.

The Batching Plant

The batching plant was set up alongside the grade, using a Butler weighing batcher with two compartments for the sand and coarse stone, followed by a Blaw-Knox batching plant for the two smaller sizes of gravel and then a Butler bulk cement plant. These were set up on a passing switch so that the trains could be handled with the greatest dispatch in batching. In comparison with some other industrial outfits seen this past summer, this contractor ran more effectively with fewer trains because of his free use of passing switches and spur track.

When a train of empties came into the plant with the locomotive pushing the cars ahead of it, the train was split into two 6-car units. The plant locomotive, a Whitcomb 7-ton gasoline machine, picked up the rear section and pulled it back to the Blaw-Knox batching plant where the two smaller sizes of gravel and then the cement were loaded. This operation required more time than the loading of the forward 6-car unit or section which was handled by the hauling locomotive. When the forward section was loaded it was merely pushed ahead and left for the Whitcomb to pick up for complete loading and the hauling locomotive went out onto the main track and picked up the rear section of the train for loading with the large stone and cement. Then when the loading of this section was completed, the two were recoupled and the hauling locomotive pulled them out onto the main line and waited for the incoming empty train to pull onto the loading switch.

The batching plant crew consisted of a delivery man handling the bulk cement into the loading hopper of the Butler plant, one cement batch man, one man below guiding the delivery hose to the cement sections of the batch boxes, one man on each of the aggregate batching plants, the Whitcomb locomotive engineer and the plant



SOME OF THE THINGS THAT WERE DIFFERENT ON THE LAMPERT & LAMPERT CONTRACT
1. A 35 tractor with a rotary scraper working on the rough grade. 2. An oil drum with one head removed made an effective separator for the air-lift well which supplied water for the mixer. 3. This tractor and mechanical scarifier broke up the surface to facilitate fine grading. 4. A tool box mounted on an industrial railway car made it possible to lock up the tools at night and readily move them along the job. 5. An effective form-puller which could be easily moved.

foreman. One man operated the Northwest crane handling the aggregate from the stockpiles to the bins. The crane had a 40-foot boom and a 1¼-yard Kiesler clamshell bucket. All aggregates were delivered by the producer by truck, a haul of about 8 miles from the pit to the stockpiles.

The contractor used four trains for hauling with a maximum 6-mile pull from the plant to the paver. These were reduced to three trains when the haul became 2½ miles or less. There were three 7-ton and one 8-ton Milwaukee gasoline locomotives for the hauling and they each handled 12-car trains of Easton cars with two Easton batch boxes per car. A feature of the contractor's method in handling his industrial railway efficiently was the laying of a 1,000-foot spur every night at the point where the paver stopped. This made it possible to run the loaded trains past the paver on the spur track for the greater part of the day and leave a clear main track for the empty to pull out on as soon as it was released by the paver. With this arrangement the contractor laid an average of 1,400 feet of 9-6½-9-inch pavement 20 feet wide per 12-hour day. The crews worked 6-hour shifts from 6 A. M. to noon, and noon to 6 P. M., completing the 30-hour week in five days but allowing for hold-ups and permitting running on Saturday if delays had occurred during the week.

GRADING

The rough grading for this contract was completed the previous year by another contractor. The paving contractor cored out the grade to approximate fine grade contour with an Allis-Chalmers 35 tractor equipped with a Drott scarifier and pulling a light 8-foot blade grader. Where the grade was particularly hard a Lakewood grade-rooter was used, pulled by the same tractor. The grading was a somewhat larger operation than it would have been with a truck hauling outfit, as it was necessary to pile all dirt on the south shoulder of the grade in order to leave the north shoulder clear for the industrial railway track. A 5-foot rotary scraper pulled by the tractor and a team with a fresno completed the dirt moving units. The team also hauled burlap for-

ward as it was removed from the slab the morning after placing.

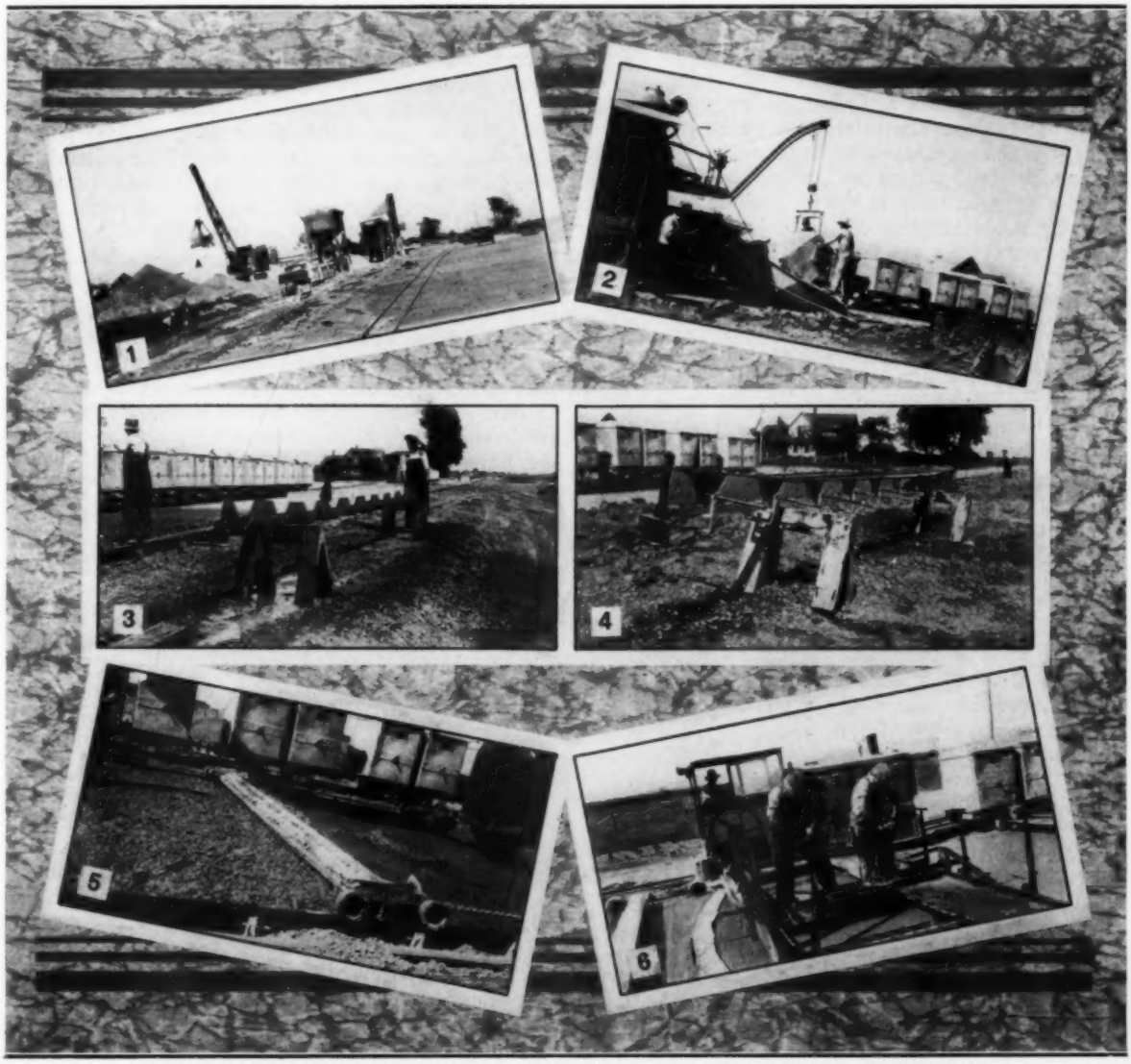
FORM SETTING AND FINE GRADING

The morning crew, consisting of two form setters and two helpers with a foreman, set all the forms for the day and the corresponding afternoon crew, consisting of a form setter and the foreman, lined up the forms set in the morning and set the new line for the following day.

The fine grade crew consisted of a tractor which operated just ahead of the forms, a blade grader man, the fine grade foreman and about ten laborers who worked with hand shovels and checked every foot of the grade with a scratch template. The grade was rolled with a 5-ton Wehr gasoline power roller between the parallel lines of 9-inch Blaw-Knox steel forms.

PAVING

Just ahead of the paver one man oiled the forms, helped drag the paver hose, picked up the center dowels which were distributed along the shoulder by the service truck, and placed them conveniently in a box on the Carr subgrade planer which was pulled by the Rex 27-E paver. Two men were used to dump the boxes into the skip of the paver, assisted by the brakeman of the train. An Arnold concrete strike-off was pulled by two 10-foot chains from the subgrade planer so that the concrete was smoothed to receive the steel reinforcing mesh. This eliminated the use of a hand strike-off



CONCRETING OPERATIONS WERE FACILITATED BY WELL-CHOSEN EQUIPMENT

1. The batching plant with its two sets of bins was set up just off the right-of-way. 2. Delivering a batch from the industrial railway to the skip of the paver. 3. The setting machine for the expansion joints. 4. An expansion joint completely assembled in the setting machine. 5. This concrete strike-off, pulled 10 feet behind the paver, left a smooth bed for the reinforcing mesh. 6. The home-made machine for inserting the center joints, showing the operators hand-tamping the wedge-shaped steel strips into the green concrete.

and, as the paver had a 25-foot boom, it was possible for the operator to place batches either on the grade to be struck off by the Arnold strike-off or behind it and on top of the mesh.

Two trimmers handled the earth collected by the subgrade planer and shoveled it to the south side of the slab. There were three puddlers and two men handled the placing of the mesh which consisted of uniform wires welded at all intersections and spaced 6 inches both ways. The mesh was placed 2 inches from the top of the slab, the depth being regulated very accurately by the Arnold strike-off. The steel men also placed the 4-foot tie bars across the center joint beneath the mesh. These dowels were ½-inch round deformed bars and were spaced 2 feet apart at right angles to the center joint.

The concrete was finished by an Ord finishing machine which did not cut any slot for the center joint. This was followed by the home-made machine for inserting the depressed joints and the center joints. The machine was built on a 4-wheel bridge and consisted of two hand tampers for driving the wedge-shaped steel strips into the green concrete to form the slot for the center joint which was poured the following day. There was also a similar outfit at the front of the machine for inserting two transverse depressed joints between the regular premoulded expansion joints which were placed every 90 feet 6 inches, thus making a division of the slab every 30 feet 2 inches. The transverse joints were driven into the concrete with 6 hand tampers of the same kind as used for the center joint. Two men handled this work and one other man picked up the steel wedges as they were removed by the finishers and brought them forward, cleaned them and placed them in the cradle on the machine ready for reuse after oiling.

The Johns-Manville asphalt expansion joint material was spotted along the grade and made up into the joints in a setting machine with 10 dowels through each joint to bond the two slabs. These dowels were ⅝-inch round bars 2 feet 6 inches long and greased before being placed. Caps of tin tubes were placed over the ends of the dowels on the side away from the paver. The special placing machine for the expansion joint consisted of a segmental steel plate of the proper depth with a cap at the top to hold the sections of expansion joint at the proper elevation. The joint material was punched for the dowels which, when pushed through, were held in place rigidly by a series of tongs with one leg set and the other swinging down to hold the dowels firmly in place until the tops of the tongs were knocked with a sledge to release the dowels after the concrete had been placed.

Following the finishing machine there were two men with a 10-inch canvas belt which was used only when the surface seemed to need this extra surfacing ahead of the longitudinal or "bull" float which was operated by these same two men from a twin rolling bridge. An interesting detail of the 10-foot longitudinal float was the method used to prevent the float from falling from the rests at the side of the bridge. A slot just above the heavy board which comprises the float proper had been left and on the end of the bridge was a short piece of strap iron bent so that it slipped into the slot each time the float was placed on the rests. No matter how the float was struck or jarred the strap iron held it from rolling off.

Two finishers followed the bull-float men and used two canvas belts, edged the slab, pulled the steel wedges of the center and transverse joints and edged the expansion joints. The bull-float men and the foreman used the checking straight-edges to insure the riding qualities of the pavement. The burlap was spread and sprinkled by two men and removed the next morning by a crew of ten men and a foreman who also covered the slab with earth. During the remainder of the day after the burlap was placed it was sprinkled by one man.

Just prior to the covering of the slab with earth for curing, the center joint, expansion joint and depressed joint slots were filled with asphalt by one man who started out with an Aeroil asphalt kettle at 4 A. M. and finished his work for the day by 10 A. M.

The night crew, in addition to laying the 1,000-foot spur around the paver, also pulled the forms, using a double tonged device made by the contractor and shown in one of the illustrations. It was very effective and exerted a uniform pull on the form at two points. After the earth cover was complete and the sides of the slab banked with earth the entire slab was wet down for seven days, this work being done by about three men. The tools for the various crews were kept in a tool box on a flat car on an extra switch behind the paver so that it could be moved readily to any point of the grade by hand.

A master mechanic was on the job at all times with a small service truck. He acted as foreman of the odd men and crews such as the pipe crew, which consisted of three men hired as needed to move the water line on the south side of the grade. They set the taps for the paver hose at 280-foot intervals and the paver carried 150 feet of 1½-inch hose.

SHOULDER WORK

The earth was removed from the slab not less than eight days after placing. This work was done by the shoulder crew, consisting of three teams with fresnos and a Caterpillar Twenty pulling a rotary scraper and an Allis-Chalmers Model L tractor with a Western 10-foot blade grader. The shoulder work was completed by spreading 3 inches of gravel for a width of 10 feet on both sides of the pavement.

PERSONNEL

This contract, one of two in the same vicinity awarded to the same contractor, was completed by Lampert & Lampert, Inc., of Oshkosh, Wis., with F. Lampert in personal charge of the work. For the State Highway Commission F. W. Sawtelle was Resident Engineer.

A Correction

In an item "Wage Trends in American Cities" which appeared on page 28 of the December, 1933, issue of CONTRACTORS AND ENGINEERS MONTHLY, there was a misstatement in regard to the wages paid to bricklayers, cement finishers, marble setters and plasterers. The wage paid to this group of workers is $1.68¾ per hour and not $.68¾ per hour, as appeared in the item.

A Unique Shaft

Sunk in Soft Ground

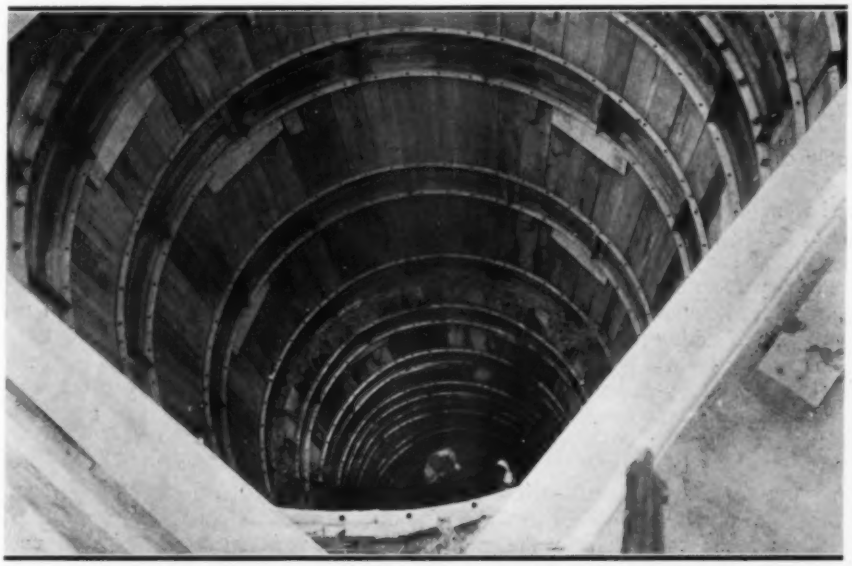
Without Wood Bracing

A NEW method of driving a shaft, eliminating interior bracing, was used recently by a Cleveland contractor. The City of Cleveland awarded Contract No. 1, Section No. 7, of the Big Creek intercepting sewer project to the Gallagher & Burke Construction Co. of Cleveland. The contract called for driving three shafts, of which the shaft at the intersection of Ardoyne Avenue and Valley Road presented an unusual problem. This shaft was 51 feet deep and consisted of 6 feet of dry yellow clay loam, 5 feet of dry coarse yellow sand, 3 feet of fine wet gravel, 9 feet of fine gray water-bearing sand and 28 feet of plastic blue clay. The usual method of sinking this shaft would have been either with air or using interlocked steel piling.

Instead of sinking the conventional wood-braced rectangular shaft in which the speed of excavation is very materially reduced by the interference of the interior bracing, the contractor decided to use steel liner plates as wales for a complete circle of 2 x 10-inch planks.

Sinking was started by excavating for a depth of 8 feet for the 12-foot diameter shaft. Inside of this and just below ground level, two rings of Truscon steel liner plates of ¼-inch thickness 16 inches wide and 37 11/16 inches long with a 2-inch flange were assembled in two rings of plates, with the top of the plates level with the ground. These rings were supported in position by four heavy planks cleated immediately under the plates. At the bottom of the 8-foot depth a single row of plates was assembled in place. Then a complete circle of 2 x 10-inch planks, 16 feet long, was set outside of both the top and bottom rings of liner plates. Four of the planks, instead of being 10 inches wide, were fan-tailed so that the bottom was 10 inches wide and the top of the plank approximately 6 inches wide. This was done so as to drive the sheeting to a larger circumference as the depth increased in order to make it possible to assemble and

(Continued on page 22)



THE OPEN SHAFT MADE POSSIBLE THROUGH THE USE OF STEEL LINER PLATES

Note the men working at the bottom, the spacing of the liner plate rings and the reduction in cross section of the shaft where the hay packing was placed to prevent an inflow of muck

1933—

Cut-Off *and* By-Pass Year *in* Massachusetts

OF the eastern states, New Jersey has in the last few years taken the lead in planning its highway construction ahead to take care of the growth of its traffic. With the completion of the George Washington Bridge and its two great traffic antecedents, the Holland Tunnel and the Philadelphia-Camden Bridge, some sane program was necessary to carry the prospective traffic across the state without overburdening the existing roads. Under the able leadership of Major William G. Sloan, New Jersey State Highway Engineer, a plan was developed and has been put largely into effect in the last five years. Its value to the state cannot be overestimated in the increased ease with which heavy traffic can move from one center to another.

Massachusetts has not been called upon to care for the great volume of traffic which confronted New Jersey but she has planned for the increasing amount of traffic that comes each year to her interesting and mosquito-freed Cape Cod. Planning ahead, she laid the foundation of a program of taking the recurrent reverse curves out of some of her main highways, shortening other meandering roads and by-passing some of the larger towns which were already overburdened with local traffic. Notable among the 1933 work of this nature were the Bourne-Falmouth cut-off, the Hyannis by-pass, the Taunton-Raynham-Lakeville-Middleboro cut-off and the Hingham-Cohasset-Scituate cut-off. The first two were sand asphalt construction; the third, which will be described in this article, a dual-type road of two 10-foot concrete strips separated by a 10-foot penetration macadam strip; and the last a penetration macadam highway.

On this 6-mile highway the penetration macadam center strip was crowned ½-inch more than the concrete strips to keep traffic from running on the macadam for long distances, and it was also set up ½-inch above the concrete when initially laid. This was done for two reasons; it made the rolling easier without damage to the concrete and second, the bituminous strip would eventually be pounded down to the level of the adjacent concrete strips and by setting it slightly above at the start, there was little chance of the bituminous material being eventually lower than the concrete and thus causing the formation of pools in wet weather and traffic hazards in cold weather.

Pouring the Concrete Strips

Following the practice of many years, Massachusetts required the placing of a 12-inch gravel subbase over the entire length of the job. This was rolled and used as the fine grade for the pouring of the concrete. The form setting and fine grade crews were under the direction of a single foreman. There were two form setters and two helpers for each crew. The grade ahead of the forms was trimmed closely to shape by a one-man power grader and then the fine grade crew of seven to eight men prepared the form line for the 8-inch Blaw-Knox steel forms. These same men also prepared the fine grade between the forms, using a wood template to get the proper elevation of the grade below the forms. A Buffalo-Springfield 12-ton gas roller compacted the fine grade between the forms and then the grade was sprinkled by one man who also took care of the high ridge left by the roller along the forms.

As the Ransome 27-E paver ran outside the forms, the two steel men were able to set the reinforcing for some distance ahead of the concrete. These two men also set the expansion joints at intervals of 57 feet. The steel reinforcing consisted of a regular network of ⅜-inch square deformed transverse bars and ½-inch longitudinal bars. The longitudinal bars were set 6, 24 and 60 inches from the forms and the transverse bars were set with the first one 6 inches from the expansion joint and then at intervals of 20 inches, and 5 feet 6 inches. At each intersection the bars were firmly tied with wire clips and supported 3 inches above the grade by sheet steel chairs, using nine for each mat.

The Carey Elastite expansion joints ½-inch thick were set every 57 feet and were punched on the job by driving a sharpened pin through them for the four ½-inch

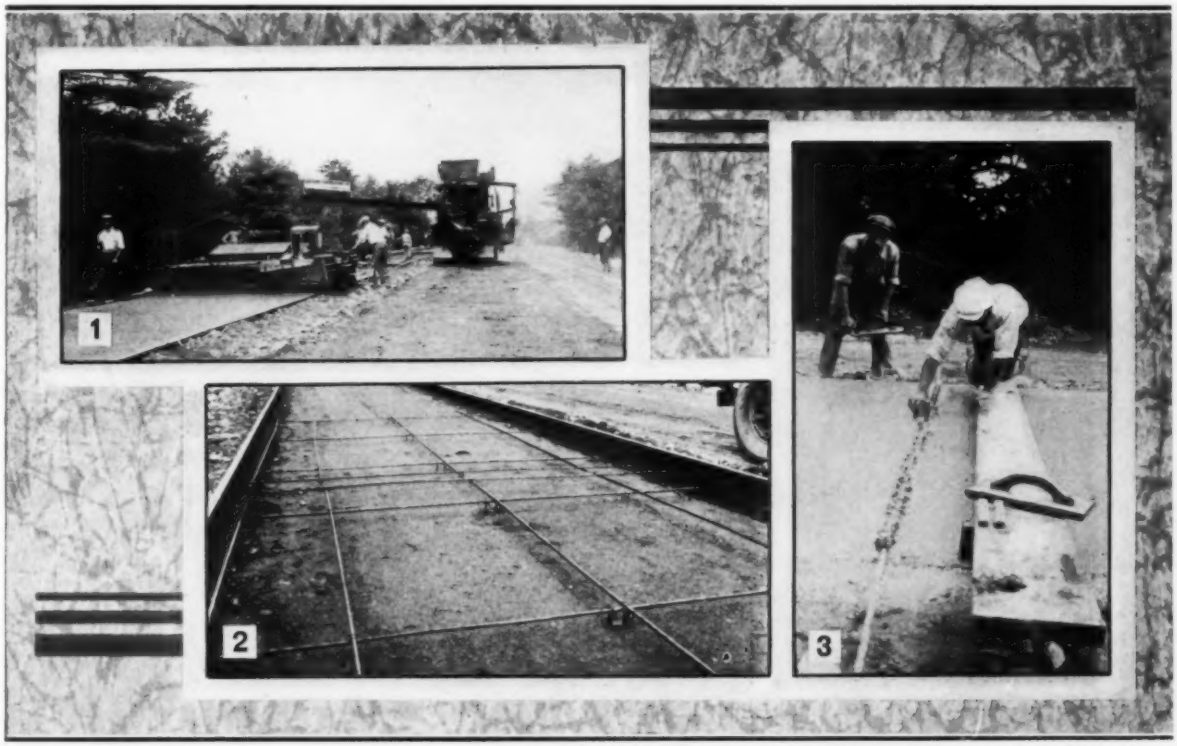
Old Narrow Roads Were Widened and Straightened and Large Towns By-Passed to Promote Traffic Movement

square dowels 4 feet long to bind the adjacent slabs. The ends of the dowels away from the paver were encased in waterproof paper caps, wire stitched at the ends. The expansion joint was set with a sheet steel bulkhead and an unequal leg cap on top. The legs of the cap were 3 and 1½ inches long. One pin was driven on the side toward the paver and two pins on the far side to support the expansion joint until the concrete was poured on both sides.

There were two men at the paver to dump the batch trucks. This was made necessary by the type of partitions used and required that the cement for the last of the four batches be supplied at the paver skip. One man sprinkled the grade just ahead of the paver. The batches of concrete, which were mixed 75 seconds, were delivered to the grade and spread by two puddlers who also spaded the sides against the forms. The Ord double screed with belt was run by one man who worked with a second man to shovel to the strike-off.

The two finishers per shift used a 10-foot checking straight-edge, edged the slab, belted it with a 6-inch canvas belt, used the fiber broom to give the non-skid tread and then edged the pavement again. They carried a hand bridge to permit them to walk from side to side and on it carried, between two small cleats on either end, a sharpened rod for picking out the caps of the expansion joints before edging the sides of the joint.

Following the completion of the finishing, a crew of five men placed the burlap which stayed on the concrete and was wet down over night. These same men spread straw as soon as the burlap was removed and the pavement checked for bumps. The straw remained on the pavement and was wet down for six days. The wetting was done by a single tank truck with a perforated arm of 1½-inch pipe which swung out over the slab and evenly distributed the water. The tank truck was filled at Pequoid Brook by a 3-inch centrifugal pump driven by a LeRoi engine. This brook crossed the right-of-way five times and there was considerable doubt whether its course could be changed legally as it was the boundary line between two towns. After considerable lengthy



PAVING A SECTION OF HIGHWAY IN THE LAKE DISTRICT IN SOUTHEASTERN MASSACHUSETTS

1. The Eastern Contracting Co.'s paver was run outside the forms to prevent cutting up of the grade by batch trucks and to permit setting of the reinforcing steel well ahead of pouring. 2. A standard section of reinforcing in place, showing the type of chairs used and distribution of the steel at an expansion joint. 3. Finishing an expansion joint from a portable bridge and showing the method of raising the cap from the premoulded expansion joint.

discussion and several conferences, it was decided to change the stream bed and thus move several hundred square feet of land from one town to the other. As land in that particular locality was selling for less than five dollars an acre at that time it made little difference in the assessment rolls of the two towns.

THE WATER SUPPLY

Water for the paver and for sprinkling the grade was furnished by a Barnes triplex pump through a 2½-inch pipe line laid along the shoulder of the road. Taps were installed every 300 feet in the line and the paver carried 200 feet of 1½-inch hose.

BATCH HAULING

A sand and gravel pit located at about the middle of the contract and ¼-mile off the right-of-way was used as the source of the aggregate. The pit was owned by Malagutti & Son of Plymouth, Mass., who batched the aggregate and was paid for the batches as delivered to the paver skip. The cement was hauled from Bridgewater, a distance of 7 miles, on a trailer holding 300 bags per load. Four men in the cement house unloaded the cement bags from the trailer in 7-bag loads on hand trucks and dumped them directly onto the batches in the trucks on the other side of the cement shed. A stock of about 500 bags of cement was carried in the house against a failure in the delivery of the cement.

Most contractors strip the forms from the slab in the morning and carry them ahead as removed. This contractor sent out a regular crew at midnight and these four men stripped the forms by the light of the automobile headlights and carried them ahead for the next day's work. They completed the work every day in about five hours so that they were continued on week after week, working only 30 hours per week.

PERSONNEL

The contractor for the 6-mile dual pavement on the Taunton-Middleboro cut-off was the Eastern Contracting Co. of Quincy, Mass., for which J. V. Pompeo was Superintendent. E. H. McElhinny was Resident Engineer for the State Department of Public Works.

A Unique Shaft

(Continued from page 19)

maintain at least a 12-foot diameter of plates at all times. As soon as the planks were driven to successive depths from 16 to 24 inches, the ground was excavated and immediately the bottom ring of plates was forced down into place.

As the excavation progressed and the 16-foot lengths of wood sheeting were driven to a greater depth, single rings of liner plates were cleated to the wood sheeting at about 4-foot intervals to brace the sheeting suitably. It was necessary at all times to keep pumps operating to prevent water rising in the shaft.

As soon as the first 16-foot depth of sheeting was driven to its full length, the same process was repeated for the next 12-foot depth, except that instead of the 12-foot diameter being used, one liner plate was omitted from the next section, which was 11 feet in diameter. There was about 1½ to 2 feet of the upper sheeting overlapping the top of the 11-foot diameter lower section. This space was packed with hay to keep water and muck from seeping over the top of the 11-foot diameter sheeting.

When the initial 16-foot and the 12-foot lengths of sheeting had been driven and excavated, the shaft had reached the plastic blue clay. In this section 4-foot wood lags were used instead of longer lengths of sheeting and the liner plate rings were used at the joint of each succeeding 4-foot course to maintain the diameter of the shaft.

PERSONNEL

This contract was successfully completed well within the contract time by the Gallagher & Burke Construction Co., Cleveland, Ohio, under the personal direction of J. M. Burke, President. For the City of Cleveland, Ross Selfridge was Inspector.

Concrete Road Design Simplified and Correlated with Traffic

HIGHWAY engineers have long felt the need of easy, rapid and accurate methods of designing concrete pavement slab to meet more economically predicted traffic needs. A booklet on concrete road designs by Frank T. Sheets, formerly Chief Highway Engineer of Illinois, and now consulting Engineer to the Portland Cement Association, has been prepared and reduces the mass of studies and research carried on by public and private organization for many years to a simple arithmetical basis which agrees fully with the more involved theoretical design.

The booklet presents a logical basis thoroughly supported for the design of concrete slab for the predominating wheel loads with appropriate safety factors for each class of road. It gives a simple method for determining the life expectancy of the slab in years and gives the relative efficiency and economy of various slab designs. Copies of this 61-page booklet which is replete with diagrams and tables are available on application to the Portland Cement Assn., 33 West Grand Ave., Chicago, Ill.

A TracTracTor and Trail-Builder in Use on a CCC Project in Clallam County, Wash.

Cutting A New Canyon Road

Hemstreet & Bell

of

Marysville, Calif.,

Grade 8.093 Miles

through

Rough Country

for a

National Forest Highway

in

Humboldt County, California

Cutting on a Steep Slope with a Tractor and Bulldozer

A NEW road through the rugged canyon of the Trinity River will soon make available to tourists the pleasures of that beautiful but up-to-now inaccessible country. The alignment of the highway follows the walls of the canyon, which are deeply serrated and have many steep slopes, and will replace an old thoroughfare which winds in and out of the gulches and around points in sharp curves, along precipitous slopes and is rarely wide enough for two cars and in some places none too wide for one. The grandeur of the country and the vistas of the river, sometimes as far as 600 feet below the road, make the new route one of scenic beauty. It will be wide enough for two cars at all points, with a maximum finished grade of 5.939 per cent and the sharpest curves having a radius of 150 feet.

The grading contract for this job, which is 8.093 miles in length between Willow Creek and the southern boundary of the Hoopa Indian Reservation and is officially known as Section A, Route 51, Hoopa National Forest Highway, in Humboldt County, Calif., was awarded to Hemstreet & Bell, of Marysville, Calif., by the U. S. Bureau of Public Roads. The original contract was for 4.587 miles and was extended 3.506 miles on August 31, 1933. The location of the work is in extremely rough and rugged terrain, with heavy timber and considerable thick underbrush. The material through which excavation was necessary was of varied nature, from ordinary earth to solid rock. Much of it was decomposed rock which appeared solid but was easily broken up with a rooter and removed with scrapers. In the sections of solid rock, explosives were used and the blasted rock removed with a shovel and trucks.

Handling Excavation and Fill

The contractor used a Le Tourneau Angledozer mounted on a tractor to pioneer the road along the hillsides and to open the way to the tops of the cuts so that the scrapers could get in. In doing this, the blades of the Angledozers were set with the point dropped on the high side, enabling the machine to dig into the steep slopes and to work in a few feet of space. As soon as the cut had been opened up wide enough for the scrapers to get in, or to permit the use of a long blade, the blades were set straight across and the machine operated as a regular bulldozer.

About 250,000 cubic yards of the excavation was done with bulldozers, scrapers and tractors; the remainder was done with a 1½-yard shovel and trucks. The cuts were laid out in series, balanced with fills wherever possible, and the scrapers proceeded through the entire series, loading in the cuts and dumping in the fills. For example, when working from Sta. 201+50 to Sta. 215, a distance of 1,350 feet or a round trip of 2,700 feet, the scrapers made the following routine trip: they started at Sta. 215, loaded at Sta. 214, dumped at Sta. 212, loaded at Sta. 209, dumped at Sta. 207+50, turned at Sta. 201+50, loaded at Sta. 203, dumped at Sta. 207+50, loaded at Sta. 209, dumped at Sta. 212, and turned at Sta. 215, ready to start the next trip. Round trips were made in an average of 14 minutes, or 4.3 trips per hour and 17.1 loads per hour per scraper. Where the scrapers were working, the rooter was kept

Making One of the Many High Fills with a Tractor and Pneumatic-Tired Scraper

busy breaking the crust of earth, to speed up loading.

LABOR AND EQUIPMENT ON THE JOB

The work on this job was done in five-hour shifts and no man was allowed more than 30 hours' work in one week. There were about 200 men employed on the project. There were three shifts daily on the bulldozers; two shifts on the scrapers and rooter and four shifts on the shovel and four trucks working from it.

Among the equipment in use on this project were the following: two Angledozers and two bulldozers, two 9-yard Carry-All scrapers and one rooter, all Le Tourneau equipment, two Caterpillar Sixties, two Caterpillar Sixty-Fives, two Allis-Chalmers Model L tractors, a 1½-yard Northwest shovel and four 7-yard White trucks.

QUANTITIES

Item	Quantity	Unit Price
Clearing	54.5 acres	$250.00
Unclassified excavation	438,300 cubic yards	.22
Overhaul	358,500 station-yards	.01

PERSONNEL

Work on this 8.093-mile grading contract was started on July 19, 1933. Clearing was quickly completed and on September 15, 115,000 cubic yards had been removed. Finishing and sloping will be done early in 1934. The contractor for this project was Hemstreet & Bell, Marysville, Calif., for whom Harry L. Townsend was Superintendent. Work was done under the supervision of the U. S. Bureau of Public Roads, with Fred J. Hughes as Resident Engineer.

Concrete Pavement Cured with Cement Spray

A NEW method of sealing the surface of concrete pavement for curing has recently been tried by the State Highway Board of Georgia, and was reported on by Searcy B. Slack, former Bridge Engineer, State Highway Board of Georgia, in a paper presented before the Thirteenth Annual Meeting of the Highway Research Board. The surface of the pavement is sprayed just after finishing with a thin layer of neat cement paste. The theory is that the cement will seal the surface pores and retain the moisture necessary for curing. Test sections using this method were compared with others using the standard wet earth curing and also where only 24 hour wet burlap was used. Strength comparisons were made on cores at 28 days and electrical resistance measurements were made to indicate the amount of moisture retained in the slabs by the different methods. Core strengths for earth and water cure were 3,388 pounds per square inch, for cement spray, 2,981 pounds per square inch and for wet burlap 2,716 pounds per square inch. The resistance tests showed good correlation with the strength tests and indicate that a resistance method of measuring moisture in concrete for curing has interesting possibilities.

Speeding Up Construction with Dynamite

AN interesting, and possibly the best, example of how the invention of dynamite has speeded up blasting operations and consequently the progress of construction jobs is found in a comparison of the driving of two tunnels through solid rock. In 1871 the Nesquehoning Tunnel in Pennsylvania was driven with power drills and black powder 105 feet in one month, a record for progress at that time. In October, 1926, one heading of the Scenic Tunnel in Washington was advanced by means of power drills, of an improved type of course, and dynamite a record distance of 1,157 feet in one month, or at about eleven times the speed achieved at Nesquehoning.

Moving an Average of 6,000 Yards of Earth Daily with Six Caterpillar Diesel Seventy-Fives, Each Hauling Two 10 to 12-Yard LaPlant-Choate Bottom-Dump Wagons 1,000 Feet or More on the A. Guthrie & Co. and Chas. Weaver Levee Job at Stovall, Miss.

The Types of Lubricants *for* Construction Equipment

The Second of a Series on an Important Phase of Efficient and Economical Operation

MODERN lubricants may be classified in two categories as Lubricating Oils and Greases. The former are refined and blended to meet conditions of service, and their value may be determined to a great degree by the care exercised in the refining process, and the field from which the crude oils are obtained. The value of the best crude may be ruined through improper refining, and the best refined oil, when used for blending or compounding, may become valueless as a lubricant when improperly combined.

It would be quite impracticable, for the purposes of these articles, to attempt to describe in detail methods of refining and compounding various lubricating oils, as it would tend to confuse the minds of many readers. It is sufficient to state that the reputable refiners and compounders have adopted standardized practices in refining, to safeguard the reputation of their products, which usually are sufficiently diversified to meet satisfactorily the demands and requirements of the consumer.

Varying types of crude oils are obtained from different producing fields and are generally known as Pennsylvania Crude, Mid-Continent Crude, Gulf Crude and Coastal Crude. The bases of these crude oils are usually designated as Paraffin Base, Asphaltum Base and Naphthenic Base. Each has specific virtues for particular uses.

Regardless of the origin of the crude from which lubricating oils are refined, an oil must possess the proper viscosity, flash, fire and cold tests, to meet the requirements of actual operating conditions, viz: loads, speeds, temperatures, etc. There are no recognized simple methods of testing oils sufficiently practical or accurate which will guarantee the satisfactory performance or service of such oil under a given condition. It invariably is incumbent on the operator to accept such recommendations as may be made by the representative of the lubricant manufacturer as to the selection of such lubricating oils as may be required for given purposes, in the absence of definite recommendations which the manufacturer of such equipment may make.

It is not advisable to use heavy viscous oils on small high speed bearings, as they would create excessive fluid friction, resulting in inadequate lubrication and increased power consumption. On the other hand, light or low viscosity oils are not adapted for massive, slow moving units, carrying excessive pressures, due to the fact they do not possess the ability to sustain the pressure or weight without breaking down, thus permitting metal to metal contact and thereby creating excessive friction, resulting in rapid bearing deterioration.

Soon after the discovery of petroleum oil, the methods of refining were perfected and lubricating oils became recognized as standard for machinery lubrication. The construction of bearings on various types of machinery in those days was such as not to permit the retention of oil, resulting in excessive waste.

Extensive experiments were made for the purpose of creating a solidified oil without impairing its lubricating efficiency. This resulted in the ultimate production of grease lubricants, the popularity of which has become more and more pronounced during the past three or four decades and which in more recent years, have become a necessity to mechanical operation.

Grease Lubricants

Grease lubricants have been developed to a high degree of efficiency and for many purposes are preferable to oil, from an effectual as well as an economical standpoint. This is subscribed to by the fact that engineers are designing mechanical units especially for the use of grease lubricants. It has been successfully demonstrated they will withstand greater pressures than ordinary lubricating oils, without the resultant waste.

A grease lubricant, combining the proper ingredients and scientifically manufactured, will form a strong and more tenacious film between the bearing surfaces than may be obtained from a more fluid lubricant. This assures prolonged life of bearings, as well as reduced labor costs for its application. Another contributing factor in favor of grease lubrication, especially in connection with mechanical equipment used by contractors,

is its natural tendency to work its way along the shaft to the ends of the bearing, where it forms a seal in such a manner as to preclude the possibility of dirt and other abrasive material entering the bearing, possibly to score and grind it away.

These lubricants are made in various consistencies or densities, ranging from a light fluid lubricant to a very hard or solid grease, that they may be selected to meet varying lubricating requirements. There are six different types or families of grease lubricants, which are applicable to machinery such as is employed in the contracting industry, as follows: Calcium Grease, Sodium Grease, Combination of Calcium and Sodium Grease, Lead Grease, Sulphur Grease, Aluminum Grease. Each of these groups has its niche in the field of lubrication, and their proper selection contribute to efficiency and economy.

Most of the calcium base greases are of the ordinary yellow cup grease type, having a lime-soap base, which makes a grease that is insoluble in water. These are manufactured in various consistencies or densities, to meet varying operating conditions. The melting points of this type of grease, range from 170 degrees F. to 205 degrees F., the determination being dependent upon the consistency.

As the name implies, the sodium base greases are made with soda-soap and are soluble in water. Therefore, they should not be used on bearings which are subjected to excessive moisture, steam, etc., unless high temperatures are the dominating factor. This type of grease is also made in various consistencies and has melting points ranging from approximately 340 degrees F. to 410 degrees F. Products of this character are commonly known as "fibre grease," owing to their general appearance, though they may or may not contain a fibrous substance, such as asbestos fibre, etc. Sodium base grease is invariably used where bearing temperatures are abnormally high, and the lubricant may be applied through the medium of compression cups, pressure systems or open-slot boxes. When unusually high temperatures are encountered, and bearings are designed with open-slot boxes, this type of lubricant is mixed with wool yarn or waste, and found to be very satisfactory.

A grease manufactured with a combination of calcium and sodium base is usually used on bearings generating temperatures which do not permit of the use of a straight calcium grease, nor are they sufficiently high as to require a straight sodium grease. The melting points of such a lubricant range from 225 degrees F. to 325 degrees F., according to the soda-soap content.

Lead and sulphur base greases are of a fluid character and are used in transmission and differential gears most successfully. They are capable of withstanding excessive pressures and are particularly adapted for hypoid and worm gears. Lead base grease is very unctuous and may be used advantageously for the lubrication of reduction gears. A very viscous oil is used in the manufacture of these lubricants, that the ingredients may be kept in suspension. When these types of greases are well made, they have unusual lasting properties and are economical.

Aluminum greases are made in several consistencies, ranging from a fluid to a semi-solid density. The fluid and semi-fluid densities are of a stringy nature and possess considerable adhesiveness. They are frequently used for the lubrication of transmission and differential gears, and the semi-fluid density is sometimes used for the lubrication of shackles and other chassis bearings. The heavier densities are transparent and may be used in grease cups or may be applied through the medium of pressure systems.

INFERIOR LUBRICANTS ARE COSTLY

The value of grease lubricants is dependent upon the quality of the materials from which they are made and the care exercised in their manufacture. Frequently greases are made to meet a price condition and the cheapest ingredients obtainable are used. Inferior fats or animal oils which may be more or less decomposed and contain an excess of fatty acids which are not thoroughly neutralized are used. These attack and pit metallic surfaces and eventually destroy the bearings. These greases invariably carry an appreciable amount of gritty, foreign substances which cause excessive wear and increases the frictional load. It would be inconsistent to use a high grade mineral oil with cheap base materials, therefore, a cheap oil of low viscosity is substituted, which breaks down under pressure and loses what little lubricating value it possessed.

Frequently the buyer is responsible for the production of inferior lubricants, as he feels it is incumbent upon him to buy as cheaply as possible, and there are manufacturers who will gladly build their products to meet any price condition which may be demanded, and by so doing break down sales resistance. It is false economy to purchase and use inferior lubricants. They create large repair and replacement expense, costly shut-downs, and incur vastly increased lubricant consumption, which more than offsets the few cents difference between the cost of a cheap lubricant and a product of quality.

There is an old saying that you can place in the hands of a dozen housewives the exact ingredients for making a cake, and when they are baked no two of the cakes are alike. This applies as well to grease makers. The best of ingredients may have their efficiency practically destroyed by improper cooking and compounding. The reputable manufacturer prides himself on the thorough methods he employs in the manufacture of his products and invariably those methods are constantly under laboratory control, which insures uniformity of quality, consistencies, etc., in his finished products.

GRAPHITE GREASES

For certain purposes, graphite greases are preferable to regular greases. While graphite may be incorporated in practically all types of greases, it is more generally used in connection with the calcium base type and is introduced during the process of cooking. The percentage of graphite used varies according to the operating conditions, but for general purposes 8 to 12 per cent is usually incorporated in the lubricant. Flake graphite has better lubricating properties, because it has good wearing qualities and readily adheres to metallic surfaces with which it comes into contact, and fills any irregularities that exist in a bearing surface, thus re-

(*Continued on page 29*)

Driving and Concreting

A Railroad Tunnel

in Shale and Limestone

THE methods and equipment used by Booth & Flinn of Pittsburgh, Pa., in driving a 1,050-foot single-track railroad tunnel for the Pittsburgh Coal Co. at Grimms Bridge, near East Liverpool, Ohio, in an almost inaccessible location, are of interest from the standpoint of operation. The tunnel section was 28 feet high and 22 feet wide and the rock encountered was mostly shale with seams of limestone. Excavation at the south portal was started on February 15, 1933, and completed on March 15, 1933, with the removal of 16,500 cubic yards of gravel and earth. The excavation at the north portal was much larger and was attended by a slide which greatly increased the excavation. The portal excavation was handled by a Bucyrus-Erie steam shovel.

Drilling the Heading and Benches

The initial tunneling operation was to drive two 4 x 4-foot drifts at either side of the tunnel at bench elevation to a depth of 30 feet and put in 30 feet of wall plate. Then the tunnel was driven with a 14-foot heading and a 14-foot bench. The drilling of the heading required twenty-five holes per round. The back or outside holes consisted of two halves at the crown of the arch and three down either side. There were three relief holes just inside the back round on either side and a single relief hole just below the two top back-round holes. The cut holes, in two vertical rows of five holes each, were drilled to a depth of 14 feet and the relief and back-round holes, 12 feet deep.

The bench was 4 feet below the spring line of the arch and at this point the wall plates were set 23 feet 5 inches apart with the vertical line of the walls 22 feet inside the neat line. The bench holes were drilled 3 inches apart and 8 feet deep along either side of the tunnel and then a set of five holes 14 feet were drilled ver-

Loading Tunnel Timbers at the Saw Mill Near the South Portal

tically to remove a horseshoe-shaped section and act as relief holes for the channeling holes. This method of drilling seldom left any toe in the bottom of the tunnel section but when any was remaining, it was drilled and shot separately. The channeled sections were shot back about 12 feet from the face on each round.

For drilling the heading, a pair of 3-inch pipe columns were set up, each carrying two Ingersoll-Rand L-74 drifters with 1¼-inch steel. For channeling I-R R-39 jack hammers were used. The rounds were shot usually between two and four in the morning when the tunnel was clear, which also gave plenty of time for the tunnel to ventilate itself before the morning work began.

MUCKING

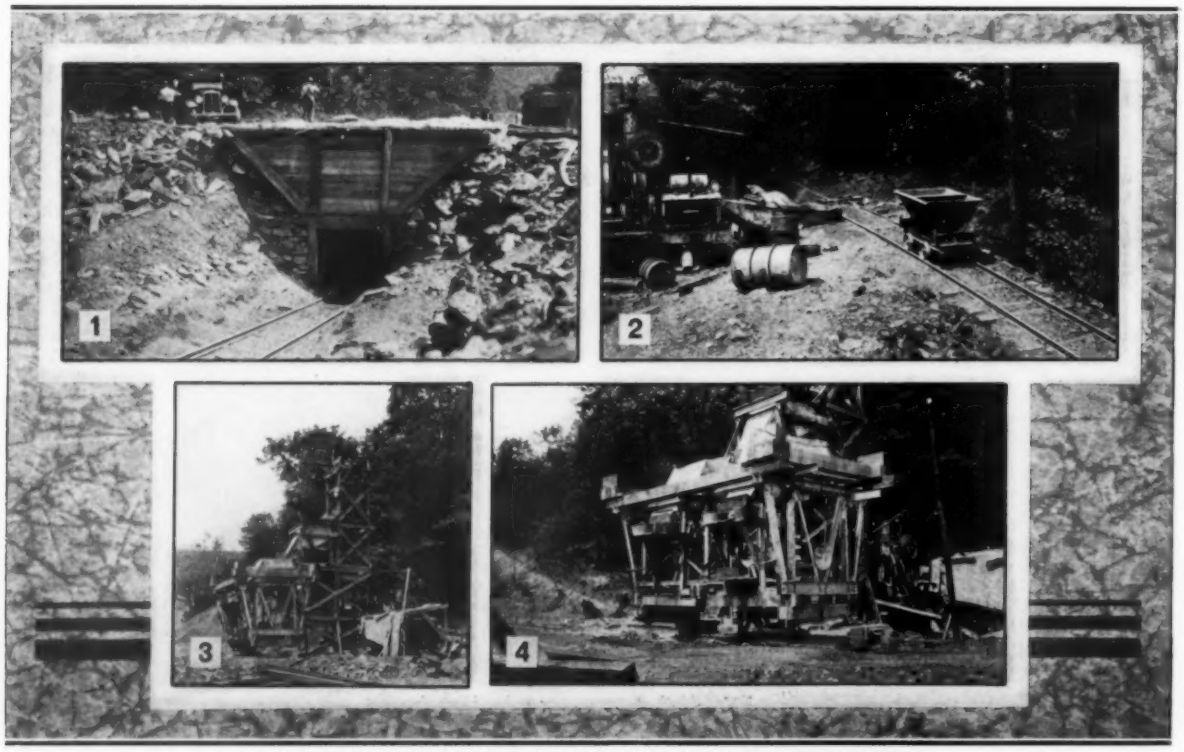
All mucking was handled by a Bucyrus-Erie Type AA air shovel with a ⅝-yard bucket and operating with 100 pounds pressure. The shovel loaded 4-car trains of Western dump cars hauled by Westinghouse electric locomotives with automatic cable reels for supplying current within the tunnel and using trolleys outside. This kept the tunnel free of bare trolley wire which carried 220 volts. The reel cable was rubber covered and heavily insulated. In completed sections where the steel forms were to be set, the track was run on the center line of the tunnel, but near the shovel it was run along the left side facing the heading with the spur track on the right. The switch was kept about 100 feet from the heading. The locomotives pushed in four cars on the main track direct to the shovel. When the first car was loaded, it was shunted onto the spur and the second car pushed forward to the shovel. When this was loaded it too was spotted on the spur and then the locomotive went back and left both the remaining empties on the main track at the shovel, returning to the spur and taking the two loaded cars off the spur. When the third car was loaded it was shunted off to the spur and the locomotive went back and left the remaining empty at the shovel and then took out the three loaded cars. As actually operated, four cars were taken out as there was always an extra car left over from the previous train.

TIMBERING

The roof of the tunnel was carried with seven segments of 8-inch H-beams with 4-inch lagging on top of the H-beams. The H-beams were set on 3-foot centers. This timbering was necessary due to a very bad condition of loose crumbly shale.

CONCRETE PLANT AND STEEL FORMS

The concrete plant was economically arranged so that one man could run the mixer and the skip car that brought up the aggregate from the tunnel beneath the aggregate hoppers. The aggregate tunnel was first built of timber on the surface of the ground and was backfilled with material excavated at the south portal. The tunnel was divided into two parts, one section for the crushed stone and the other for the sand. There were two sand gates in the top of the tunnel and three for stone. The sand and stone bins were then built above and the fill carried up to the top of the bins so that the trucks hauling the aggregates from East Liverpool,



BATCHING AND CONCRETING PLANT FOR THE TUNNEL JOB

1. The aggregate tunnel and hoppers. 2. The skip car for batching the aggregate in the tunnel. 3. The gasoline-powered skip car hoist, mixer, concrete tower and tunnel concreting car. 4. A close-up of the concrete car at the mixer.

Ohio, could dump direct to the bins. The sand bin had a capacity of 100 yards and the stone of 200 yards. The services of three men for about four hours a day were required to see that the aggregates were placed within the bins and running freely for concreting. A Koppel side-dump industrial railway car with a partition dividing it in the proper proportion for the batches of stone and sand was run on a track into the tunnel by gravity and pulled out by one of the drums of the Lidgerwood hoist which also operated the Ransome concrete tower bucket. The hoist was an old steam unit rigged with a Waukesha engine driving it through a Link-Belt chain.

The labor organization for the concreting plant consisted of the hoist engineer, one man riding the aggregate car and filling it in the tunnel, three men dumping cement into the skip of the Ransome 27-E paver and dumping the skip car, and one man on the concrete car. The concrete plant had a 4-yard Ransome concrete hopper in the tower built up with wooden sides to hold 6 yards.

The car for carrying the concrete into the railroad tunnel to place it around the steel forms performed a double duty as it also previously set the steel forms. It consisted of a pair of industrial railway cars of 36-inch gage running on the regular track of the muck cars. This track, in addition to being set to the center line of the tunnel, was also set to a grade about 1 foot 5 inches above the subgrade of the tunnel. The car carried two Ransome 4-yard concrete hoppers within the structural frame where they were out of the way when the car was used for setting the forms. The car also carried several wood chutes lined with sheet metal for placing the concrete in the footings which were poured ahead of the setting of the steel forms. Concrete around the forms was placed with a Press-Weld pneumatic placer, recently developed, which handles 10 cubic feet of concrete at a shot.

Power Plant

The power plant was completely diesel-operated. A 180-hp Fairbanks-Morse 6-cylinder diesel operated a 120-kw alternator to furnish power for the compressor motor and for lights. A 60-hp, 4-cylinder Fairbanks-Morse diesel engine ran a 55-kw direct current generator supplying power for the electric locomotives. An 800-kw direct current Kohler electric unit was installed as an emergency unit to supply lights in case of a breakdown of the larger unit. A 3-hp Fairbanks-Morse gas engine was installed to operate a small air compressor supplying starting air at 250 pounds pressure. A 1,000-gallon fuel oil tank was located just outside the main door to the power house for the larger engine and a smaller 200-gallon tank was inside for the smaller engines.

An Ingersoll-Rand Imperial Type 10 compressor, furnishing air at 100 pounds and with a rated capacity of 1,100 feet of free air per minute, was driven by a 200-hp General Electric motor. As a booster on the air line, a 350-foot Gardner-Denver portable compressor was located outside near the south portal of the tunnel.

A 6-inch air pipe was carried to the portal of the tunnel and into within 150 feet of the heading. A T was inserted and a 3-inch air hose was carried along the grade for the air shovel and an overhead line of 3-inch air hose was carried along the wall plate for the heading and bench drills.

The Doorway of the Power Plant Showing Safety Posters

Carpenter Shop

A saw mill located close to the south portal and just off the tracks ripped lagging and made wedges and "joggle" blocks to go between lengths of steel.

An Ingersoll-Rand air tugger hoist was attached to the side of the tunnel at a convenient location and used with a long cable to raise lagging and steel in the heading. Inside the tunnel the lights were strung along the top, giving adequate illumination at all times. Night illumination outside the tunnel was accomplished with pairs of 60-watt lights inserted in 15-cent dishpans as reflectors.

Two shower baths were maintained at the power house, one for white and one for colored employes. Hot water was supplied by using the condenser water from the engines.

Personnel

The contract for this tunnel was awarded to Booth & Flinn of Pittsburgh, Pa., by the Pittsburgh Coal Co. For the contractor the work was in charge of George Hockensmith, Vice President and General Manager with G. M. Bateman, Day Superintendent and L. Curtis, Night Superintendent. For the Pittsburgh Coal Co., E. S. Taylor was Chief Engineer and W. H. Hamilton, Resident Engineer.

The Types of Lubricants for Construction Equipment

(Continued from page 26)

ducing its roughness and producing a better surface for lubrication.

Effect of Temperature Changes

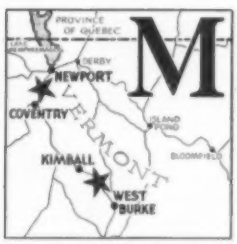
Many lubricants are affected by extremes of seasonal temperatures, making it advisable to use one grade during the warmer months and another grade during the colder seasons. Most manufacturers are cognizant of the effects of heat and cold on their products, and allowances are made in the construction of their lubricants to meet those conditions, without impairment of their efficiency.

As it is impracticable for contractors generally to maintain laboratories for the purpose of checking their lubricants to determine whether or not they conform to such standards as may be set, it is advisable to purchase standard brands, which have an established and recognized reputation for quality and uniformity, even though the first cost may be a trifle higher.

Two of a Kind

Gravel Mixed-in-Place Contracts

in Northern Vermont



MIXED-IN-PLACE surface is the major type of construction in Vermont in these days of economy. Motorists who have ridden over the scenic highways of the Green Mountain State appreciate that what Vermont builds, she builds well, whether it be a concrete pavement or a gravel mixed-in-place surface. The now historic flood of the fall of 1927 might be said to have initiated a new program of road building in Vermont. All during the winter of 1927-28, survey parties worked under the most severe weather conditions preparing new alignments for roads, new locations for bridges and from 1928 right up to the present time modern road construction has been the keynote of the program.

The general financial stringency has made it necessary to increase the mileage of less expensive construction, but these roads are well built and some day will make excellent foundations for higher types of paving. As soon as Vermont received its money under the N.I.R.A., it immediately awarded a contract for the construction of a road betwen Woodstock and White River Junction on U. S. Route 4, over the right-of-way of the Woodstock Railroad which was used as a road bed. This was the only concrete pavement to be built during 1933.

Many miles north of Woodstock and White River Junction and located close to the Canadian border were two grading and mixed-in-place contracts on U. S. Route 5, posted as the Portland-Montreal Highway. These two contracts, totaling about 13 miles in length, were awarded to the Lane Construction Co. of Meriden, Conn. The first, about 7.4 miles in length, extended from the Burke Town line through the town of Sutton to the Barton Town line. The other section, about 12 miles north, was 6 miles in length and extended from Coventry to Newport, the latter town being only 9 miles from the Province of Quebec. The quantities and unit prices on the Burke-Barton section were as follows:

Item	Quantity	Unit Price
Rock excavation	2,950 cubic yards	$0.40
Common excavation	52,655 cubic yards	0.40
Subbase gravel	31,690 cubic yards	0.55
Patrol maintenance	54 days	10.00
Gravel mixed-in-place surface	5,483 cubic yards	3.75
Refined tar	200,950 gallons	0.12
Concrete, Class A, 1:2:4 mix	140 cubic yards	16.00
Reinforcing steel	10,100 pounds	0.04
Cement rubble masonry headers	125 cubic yards	8.00
Reinforced concrete pipe, 12-inch	196 feet	0.90
Reinforced concrete pipe, 15-inch	608 feet	1.25
Reinforced concrete pipe, 18-inch	1,740 feet	1.50
Reinforced concrete pipe, 24-inch	452 feet	2.50
Reinforced concrete pipe, 36-inch	40 feet	6.00

The quantities on the Newport Coventry section were:

Item	Quantity	Unit Price
Common excavation	9,050 cubic yards	$0.50
Subbase gravel	12,800 cubic yards	0.50
Gravel mixed-in-place surface	4,240 cubic yards	3.75

The refined tar figure is included with that noted in the Burke-Barton section.

On excavation for drainage structures to a depth of 5 feet, the Vermont specifications require that a factor of 1.5 be applied to the common excavation figure. For structure excavation greater than 5 feet, the factor is 2. Payment for excavation is made for a trench 1 foot on both sides outside the nominal diameter of the pipe to be installed.

Clearing and grubbing with a real crew of lumberjacks started on July 10, 1933, and the first shovel went onto the southern section on July 16.

Excavation on the Southern Section

The finished roadway is 18 feet wide with 3-foot shoulders on each side of both the Sutton and the Coventry sections. The latter, however, had no bad spots, as the major excavation was confined to the southern section as is seen in the quantities above.

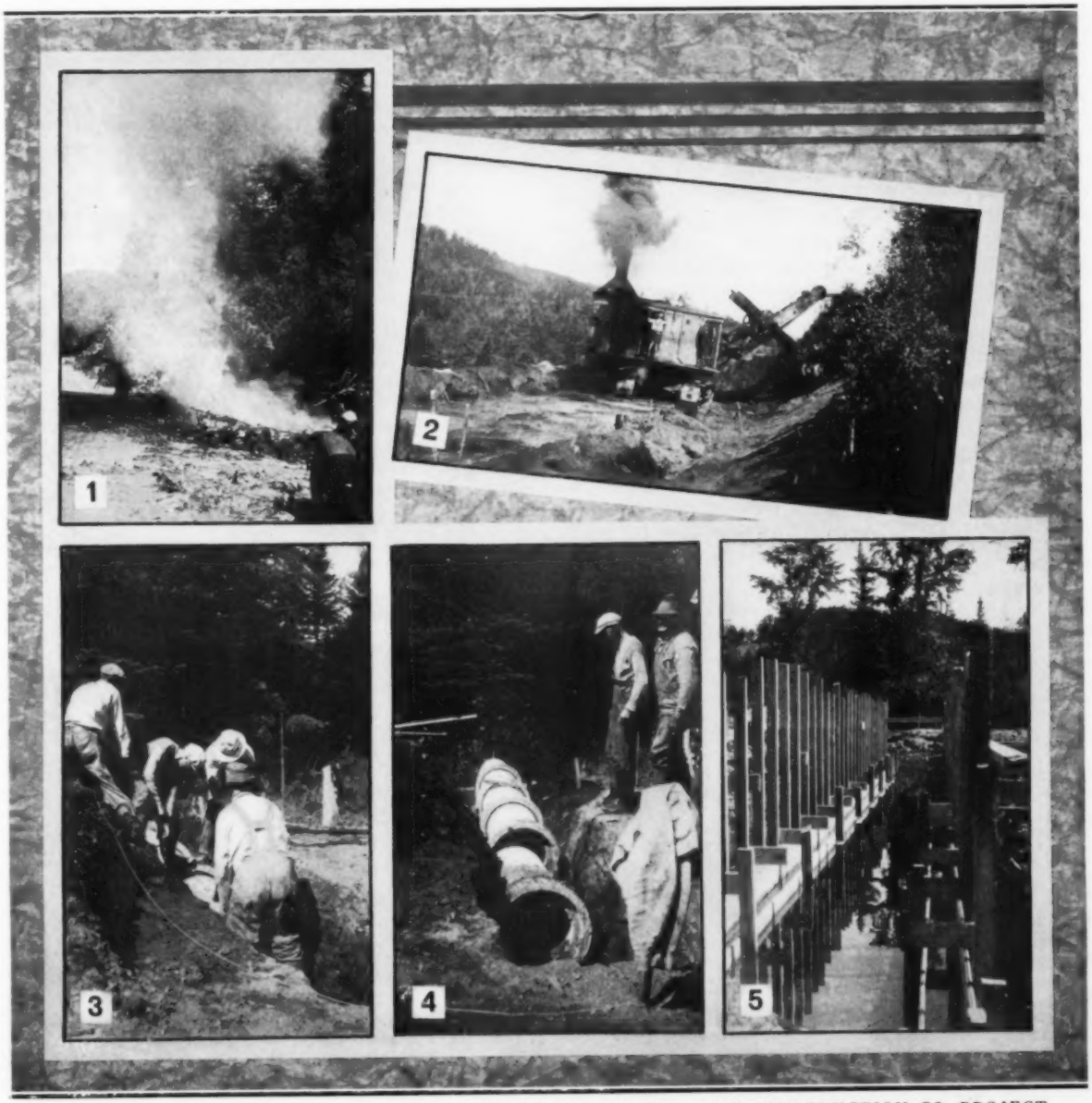
Excavation on the southern or Sutton section was handled by a Bucyrus-Erie 42-B 1½-yard steam shovel and a Bucyrus-Erie ⅞-yard steam shovel. The contractor used three trucks with each shovel, as the haul was seldom over 500 feet and averaged about 400 feet. There was one pit man with each shovel and four men on each dump. These men were used in hand trimming the shoulders as well as on the fill. Two Bates 35 tractors with bulldozers were used for handling the larger rock which were too big for even two men to move readily, and for compacting the fill. After the job had been in operation about ten days, a Bucyrus-Erie ⅞-yard shovel was added to the excavating equipment.

There was very little ledge on the Sutton section, but there were many large boulders which it was necessary to block hole to facilitate handling. A portable Ingersoll-Rand compressor mounted on a truck and equipped with one jack hammer was used for this light drilling.

On one station on this section, where a cut was called

for to carry the gravel base, the excavation ran into muck, so the contractor was instructed by the engineers to leave the old road, which was well compacted, as a base and fill with gravel to a new grade. An interesting feature of the operation of this job was the trimming of the slope close to the shovel in all the cuts by hand labor. Many contractors leave this operation until the end so that until a few days before the contract closes up the entire job looks ragged. With this contractor. while a shovel is working in a cut, the slopes are trimmed according to specifications and the operation as far as excavation in that cut is concerned is completed. The specifications called for a 2-foot ditch with a 1 on 2 slope next to the road and a 1 on 1½ slope on the far side with a minimum depth of 2 feet 3 inches below the shoulder. The excavation on this southern section was practically side-hill throughout.

All culvert pipe trench was done by hand and the pipe placed by hand. All culverts and trenches were backfilled with gravel loaded by hand and the box culverts were poured with a one-bag Jaeger mixer. On the culvert, one set of forms for which are shown in the illustrations, the ground was so soft that it was not deemed wise to pour it until after the grading had proceeded up to that section from the two sides. The pouring of this culvert, which was in a cut-off section, was further postponed until the surfacing had been completed because of a delay in starting the plant to produce the concrete



CLEARING, GRADING AND DRAINAGE OPERATIONS ON THE LANE CONSTRUCTION CO. PROJECT IN NORTHERN VERMONT

1. The burning of dry brush in the roadway speeded clearing. 2. Cutting side slopes and ditches with a steam shovel. 3. Lowering an 18-inch reinforced concrete culvert pipe into place by hand. 4. Culverts were laid half the width of the road at a time to permit continuous hauling. 5. Forms for a 4 x 5-foot culvert 42 feet long on a cut-off section. This work was done by a local journeyman carpenter after careful instruction from a foreman.

aggregate. The culvert was cured for 12 days before the fill was carried up to the concrete.

Excavation on the Newport Section

Two ⅞-yard Bucyrus-Erie steam shovels were used in the gravel pit for surfacing after they had handled the light cuts required by the plans. A Galion power grader handled the moving of the larger stones on the fill, the final trimming being done by a crew of four men. The gravel base was rolled with a Buffalo-Springfield 12-ton gas roller and a Buffalo-Springfield 10-ton steam roller.

The Mixed-in-Place Operation on the Two Sections

The mixed-in-place top was 2½ inches thick and 18 feet wide. One-half gallon of 40-viscosity tar was applied with a pressure distributor on the shaped-up stone and one round trip was made with the Galion 20 retread machine pulled by a Linn tractor and a Cletrac. Then 0.4-gallon more tar per square yard was applied over the entire surface. One trip of the retread machine through the middle of the roadway and two round trips completed the mix. The final shaping was done with a Caterpillar Auto-Patrol grader.

Actual mixing of the 7.4 miles of the southern section required nine days, starting September 28, 1933, with a maximum daily mix of 8,110 linear feet. The seal coat required four days because of rainy weather. The mix on the northern section required a longer time because of the smaller stone output. One day's mix, however, was 7,000 linear feet.

Personnel

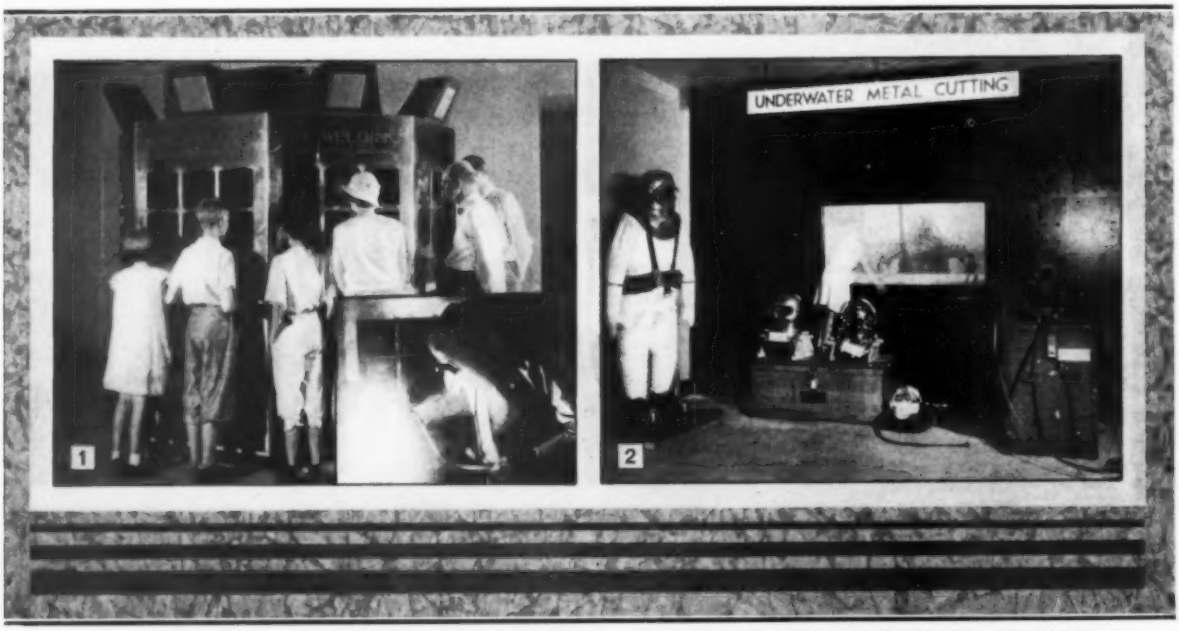
For the Lane Construction Co. of Meriden, Conn., contractor on both the Sutton and Coventry sections, Frank E. Bowen was General Superintendent, with E. D. Moore as Assistant Superintendent on the Sutton section and Arthur Pixley as Assistant Superintendent on the Coventry section. For the Vermont Department of Highways, E. B. Bly was Resident Engineer on the Sutton section and Nathaniel Colby, Resident Engineer on the Coventry-Newport section.

Unique Museum Display of Arc Welding

TWO very interesting exhibits of arc welding form a part of the first section of the new Museum of Science and Industry opened recently in Chicago. Housed in a booth of stainless steel, itself fabricated by welding, an operator demonstrates the use of the electric arc and explains the process, speaking into a microphone connected with loud speakers outside the booth. The stainless steel booth was constructed of very light gage sheets but no difficulty was experienced with warping. The welds were ground and polished so as to be practically invisible. Special glass permits visual inspection of the welding inside the booth without danger of injury to the eyes.

To demonstrate the cutting of steel under water, a large tank has been constructed in the main hall of the museum. A diver in regulation deep sea dress actually cuts a steel bar with an oxy-electric torch while submerged in the water. A microphone located in the diver's helmet permits him to explain the cutting process as used in salvage work, while submerged in the tank.

The equipment on display for both the welding and cutting demonstration consists of a Shield Arc welder and accessories loaned to the museum by the Lincoln Electric Co., Cleveland, Ohio. To complete the welding exhibit many examples of electrodes and weld test specimens are on display. The museum, founded by Julius Rosenwald to reveal the technical progress of man, will contain 11 miles of exhibits when completed. All of the displays are not expected to be acquired before 1935.



ARC WELDING AND UNDERWATER CUTTING AS SEEN IN THE MUSEUM OF SCIENCE AND INDUSTRY IN CHICAGO

1. While the welding operator demonstrates his art, he explains the process through a public address system. (The insert shows the welder at work as seen through a window.) 2. Totally submerged under water, a diver cuts a steel bar with an electric torch.

The Editor Comments

Personal Observations and Reflections

At Last the Construction Industry Code Has Become Law

After a long drawn-out battle with labor, the group of men who have labored faithfully since early last summer to produce a Code for the Construction Industry which would unify the entire industry and raise it to a higher level, has had the satisfaction of having its efforts approved by the President on January 31, 1934. Probably no Code presented to the National Recovery Administration for approval has been backed by a group of men more altruistic and determined that the product of their efforts should assure a fair deal to all component parts of the industry as well as to consumers.

The Code of Fair Competition for the Construction Industry, which is the official title of the legislative act which the Construction Industry has written for itself, was submitted to the National Recovery Administration by the Construction League of the United States and its allied associations and will become effective March 2, 1934. The Construction League Code Committee, to which great credit is due for the manner in which the Code has been written and upheld in the many heated discussions during its formative period, consisted of Stephen F. Voorhees, Architect as Chairman; John P. Hogan, Engineer as Vice Chairman; F. P. Byington, Materials Contractor; Willard T. Chevalier, Engineer-Publisher; C. H. Dabelstein, Painting Contractor; P. W. Donoghue, Plumbing Contractor; A. E. Horst, Engineering Contractor; and William Steele, 3rd, Builder; with J. W. Follin, Engineer as Secretary. This Code is really only the first chapter of the Master Code of the Construction Industry and it will be followed by further chapters based upon it and submitted by between twenty and forty national associations allied with the industry.

Labor objected strenuously to the Code and delayed its final approval for several months. Labor's chief objection was the fact that the Code includes the building trades in which labor is most highly organized. The gains which labor has made in the building industry were made possible by the fact that it dealt with small groups of employers and it saw a possible defeat in having to deal with a united industry.

The Construction Industry Code, which covers fully three million workers in the building and heavy construction trades, is believed to be the first which provides for the equal representation of labor and management on the Planning Board of the industry. Labor has been fighting for this provision ever since the enactment of the National Industrial Recovery Act. Under this Code a National Construction Planning and Adjustment Board of twenty-one members is created. Ten of these members are selected by labor, ten by the employing group and one by the President. The twenty-one employment groups which had sponsored the Code and which composed the Code Authority will select the ten industrial members on the Planning Board.

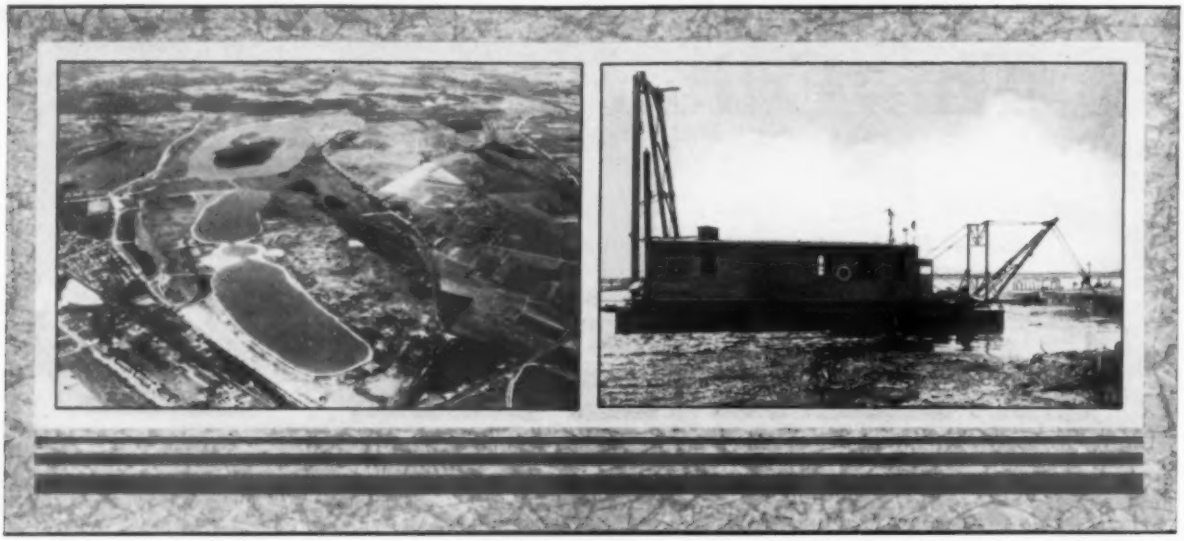
The flat minimum wage for common labor engaged in construction throughout the United States has been set at 40 cents an hour instead of the original provision for a lower rate. In any one of the divisions of the industry the 40-hour per week maximum employment hours set up in the Code may be reduced to make it possible to share available work but this can only be done by the mutual consent of employers and employees within the particular division of the industry affected. Further, if employers feel that this shortening of hours cannot be done without undue hardship to them, the joint Board is called upon to arbitrate.

The Construction Industry is to be congratulated that it could develop a Code satisfactory to the component parts of the industry, eliminate the native American pastimes of chiseling, bid peddling and bid shopping, and take a definite stand for the prequalifications of bidders, for the award of contracts at the bidders' original bid price and for the honest receipt of bids to prevent collusion. No paragraph or word in the Construction Industry Code places any restrictions upon allied industries as has been done in other Codes which have been submitted and approved.

Conflicting Codes to Be Harmonized

The National Recovery Administration has approved about 225 Codes and has around 350 more to review before final approval. General Hugh S. Johnson up to this point has placed major emphasis on the production of Codes but now has turned definitely to their refinement, that codes in different industries may harmonize. Thus the conflict which we have mentioned in these pages from time to time between the Codes of manufacturing industries serving the Construction Industry will be reviewed with the idea of preventing one industry strangling any part of another legitimate enterprise.

Theodore Reed Kendall



The Reclaimed Area at East St. Louis, Ill., Showing the Three Lakes, and the Dredge Which Did the Entire Job

East St. Louis Transforms Swamp Land to Park Land by Dredging Operations

IN 1928, an apparently hopeless, worthless, mosquito and weed-infested swamp; in 1933, a beauty spot and recreational center twice as large as Central Park in New York City or the Century of Progress Exposition in Chicago—that is the story of a remarkable transformation at the outskirts of East St. Louis, Ill., handled under contract by the Minneapolis Dredging Co., Minneapolis, Minn.

The improvement comprised about 2,000 acres, originally a shallow lake bordered with a marsh bog. Over 20 years ago, a small group of public spirited citizens visualized the possibilities of the vast swamp and finally under the leadership of Park Superintendent, Emmett P. Griffen, overcame the legal and financial obstacles and awarded the contract to the Minneapolis Dredging Co., which used a Morris Machine Works dredge on this huge undertaking, involving the excavation of 4,000,000 cubic yards of material, equivalent to 1,300,000 truck loads, from the bed of the old lake and redepositing it so as to form three smaller and deeper lakes of various shapes, as well as raising the level of the adjacent land for further development. By using a hydraulic dredge, the multiple operations of excavating, pumping, conveying and depositing the material were all done with a single piece of equipment.

For 24 hours a day, 7 days a week, month after month, this dredge steadily worked its way along the lake, its cutter loosening the compacted material so that it could be sucked up by the motor-driven centrifugal dredging pump which delivered the mud, clay, sand, gravel and stones through discharge pipes as much as a mile in length. Besides the three lakes and park land which have been formed, the new Lake Park project is to include a 18-hole golf course, tennis courts, a game refuge, bathing beaches, bridle paths, 45 miles of boulevards, and athletic fields for all popular sports. Swimming, fishing, boating and water sports will be permitted in the lakes, and the increased civic value of the reclaimed area is incalculable.

ROAD CONSTRUCTION AT BARBERSVILLE, W. VA.

1. A view of the project of Harry Hatfield, Contractor, taken at noon hour and showing the character of the country through which this road is being built. 2. The Lima shovel loading a 12-yard Le Tourneau wagon pulled by an Allis-Chalmers Model L tractor.

A Contributor to *No. 7*

Construction Progress

THE development of public interest and backing for good roads, the organization of the highway industry for co-operation with the Federal Government in the problems of highway construction and maintenance, and the establishment of a central bureau for stabilizing credit extended to contractors, eliminating the "fly-by-night" operator, have been materially influenced by one energetic individual. Samuel Marshall Williams, a native of Bedford County, Pennsylvania, has applied his ability as an organizer to many successful efforts to improve conditions effecting the construction industry.

Soon after he became associated with the Peerless Motor Car Co. in the sale of Peerless automobiles and trucks in 1912, he realized that the lack of improved highways was a serious handicap in the sale of automobiles and began to study the problem from an economic standpoint. He assembled a large number of lantern slides at his own expense, illustrating road conditions before and after improvements. In 1914, Mr. Williams suggested to the automobile industry an educational campaign to reach school children and through them the parents, but nothing was done. In January, 1915, he became Sales Manager of the Garford Motor Truck Co. of Lima, Ohio, and immediately began to interest his associates in a campaign for good roads. Under Mr. Williams' direction, a campaign was undertaken and illustrated leaflets telling the story of good roads and their influence on home life and land value were distributed in public schools and in many colleges throughout the United States. Supplies of this leaflet were secured for good roads campaigns throughout the country and in one campaign for a $1,000,000 bond issue in one of the eastern states, the engineer in charge stated that the leaflet had been a very important factor in carrying the bond issue.

Mr. Williams relates an interesting episode in his experience while he was giving his illustrated lectures in order to present the value of good roads. Some of the meetings he conducted were in danger of riot because of the opposition due to fear of increased taxes. However, he had so arranged his presentation of the discussions of the need of better roads that he won his audiences. He tells of one meeting advertised in one of the southern counties of Texas. Upon reaching the county seat about 4.30 in the afternoon, he was informed that the meeting had been called off because of threats of breaking it up. He insisted upon holding the meeting, with the statement: "If I cannot hold my audience, I do not deserve one." The meeting was not only held, but the courthouse was filled—possibly the crowd was partly due to anticipation of a row. Before the meeting progressed very far, those present were applauding and in less than one year, the same county had voted a good road bond issue of $1,000,000.

Through the efforts of Mr. Williams a resolution was adopted in 1916 by the Atlantic City Convention of the Chamber of Commerce of the United States endorsing the building of good roads. In 1918, he was instrumental in organizing the Highway Industries Association, representing manufacturers of equipment and producers of materials used in the construction of highways, for the purpose of cooperating with the Federal government in its problems of highway construction and maintenance. Late in 1922 Mr. Williams returned to the motor truck industry and later became Vice President of Autocar Sales & Service Co., Ardmore, Pa.

Moffett Studio

S. M. Williams

After three years of effort, Mr. Williams, as Chairman of a committee composed of engineers and representatives of surety companies, succeeded in November, 1925, in securing the approval of the American Association of State Highway Officials of a standard questionnaire covering the financial responsibility and experience of bidders. This questionnaire is now in use in its original or modified form by practically all state highway departments, and many municipalities and larger counties.

In 1928, Mr. Williams left the motor vehicle business, with which he had been associated for sixteen years, and became affiliated with the Associated General Contractors of America for the purpose of stabilizing work of credit extended to the construction industry. While much was accomplished, the work was seriously handicapped because many contractors were not willing to accept standards for themselves, even though they prescribed them for others. In 1929, the Bureau of Contract Information, Inc., was organized, with Mr. Williams as President, through cooperation of practically all of the larger surety companies, representing 90 per cent of all surety contract bonds written in the United States. The Bureau of Contract Information, Inc., with headquarters in Washington, D. C., is an unbiased, non-profit making, fact-finding institution. It has in the past and is still performing a very important work in the interest of responsible construction. It is regarded with confidence by public officials, architects and engineers who award contracts for construction and, by virtue of the extensive cooperation between the Bureau and all departments of the Federal government awarding construction contracts, and all state highway departments, it is now recognized as a semi-governmental public service. In the support of the work of the Bureau, under the direction of Mr. Williams, surety companies have contributed the sum of $254,000, as their share in the interest of responsible construction.

How the Other Fellow Did It

Ideas That Have Already Proved Helpful to Contractors

A Dependable Master Straight-Edge

282. Many contractors carry a heavy 2 x 12 plank from 10 to 12 feet long and carefully planed on one edge to a true line as a master straight-edge for testing their dragging and checking straight-edges. An Illinois contractor realized that the constant wetting of a wooden master straight-edge would cause it to become irregular so a steel channel iron about 6 inches wide was accurately machined on the top flange to a perfect edge. This 10-foot steel channel was carried on one of the two finishing machines on this job and was used as the master straight-edge every morning and several times a day for all checking and drag straight-edging. This was particularly important under the Illinois specifications as the forms were straight-edged every morning by inspectors to see that there was no deviation of the top surface of any section from a true straight line. 25.3.29

Dowels Across Center Joint Spaced by Machine

283. A Michigan contractor, who had had many arguments with zealous inspectors over the accurate spacing of the dowels placed below the mats of reinforcing steel and across the center joints, devised a simple machine which does the work accurately and eliminates any possibility of argument. The machine consists of two pieces of 1 x 3½-inch plank smooth on edge and spaced 5 inches outside measurement. At the top the planks are firmly held together every 18 inches by 3 x 5-inch blocks of 1-inch material for rigidity. This makes a U-shaped box. In the bottom edges of the side pieces, there are notches cut at 2-foot intervals for the insertion of the dowels, this assuring the proper spacing. To hold the dowels in place when the machine is inverted, there is a J-bolt for each bar. These bolts are attached to a strip of 1 x ¼-inch iron running the full length of the device and a little beyond at each end. This strip is held in place and permitted to slide freely in blocks at intervals of about 3 feet. When the dowels are in place, the iron strip is pushed forward so that each J-bolt engages one dowel and holds it firmly in place while the device is inverted. Then when the dowels are to be placed in the road, the device is simply laid on the green concrete, the iron strip pulled back and the dowels released and accurately spaced. When the dowels were to be placed, the two steel men, who worked entirely outside the concrete, handed the dowel spacing machine to the puddlers who laid it on the concrete, pulled the bar and dropped the bars in place. 25.4.29

Making the Wheeling of Lip Curb Concrete Easier

284. In building lip curb in the middle west states where its construction is required, some contractors leave trays of concrete covered with burlap along the edge of the road. One Iowa contractor had the concrete wheeled back to the lip curb builders. If any one has watched the struggles of a strong laborer trying to push a wheelbarrow over a rough road shoulder, he may think this method is useless but this contractor used 2 x 12-inch planks from the paver back to the section where the lip curb was being run. Thus the work of the wheelbarrow man was made much easier and the concrete arrived at the curb in the very best condition direct from the paver instead of having stood for an indeterminate period in a tray on the shoulder. 25.2.18

The Cement Dock Again

285. An Iowa contractor realized that he wasted a lot of lumber when he built a new cement dock on every job. He also realized that setting it up on nail kegs was not satisfactory so instead of using either of these methods, he bought a set of steel horses built up from structural steel sections so that the dock could be set up in units 16 feet long. These units could easily be taken down and moved to the next job and the horses could be used parallel with or at right angles to the line of the rails of the freight track and were thus useful in any kind of a set-up. 25.2.15

Placing Stone and Rolling Base on Penetration Macadam

286. In Massachusetts a great deal of care is taken in the construction of the penetration macadam roads which constitute a large part of the State Highway system. Stone spreaders of the box type are usually used attached to the trucks and then the stone is trued up by men with stone forks and double-handled two-man long-tined rakes known as "bull rakes." During the rolling of the base course particular care is taken to roll the shoulder at the same time for a distance of about 18 inches from the edge of the stone so that the base will not be squeezed out into the shoulder and the stone wasted. 25.4.34

Greasing Crawler Equipment on Arkansas Levee Project

287. A levee contract where 2,800,000 yards of dirt was being moved boasted a blacksmith shop with no blacksmith but with a very complete electric welding outfit and an acetylene welding unit. During the day when all major repairs were made there were one mechanic and five helpers at work and at night, three mechanics. The mechanic's helpers made up the greasing crew which saw to it that every wagon and tractor was greased twice in each 24 hours. The greasing periods were from 5:30 to 6:30 both A.M. and P.M. and at noon and midnight. Six open air "stalls" for the greasing were arranged with trouble lights strung from overhead. The electric current for the lights and for the electric motor on a pneumatic greasing machine was provided by a portable electric plant housed in a small wooden shack at one end of the greasing line. By using the mechanics as greasers each piece of crawler equipment was gone over quickly twice a day for minor adjustments and if trouble was located the master mechanic ordered the unit out of service so that the adjustment or repair could be made immediately before a breakdown occurred. 25.5.23

A 23-Foot Screed for Concrete Bridge Deck

288. In order to provide as nearly a perfect riding slab as possible on a concrete bridge, a Georgia contractor used a 23-foot screed for floating the 20-foot sections of the deck. The screed was made of three pieces of 2 x 12-inch lumber bolted together and shod with a 6-inch channel iron. It had heavy iron handles at each end for the men operating it to use in pulling it back and forth. One man was used at each end as with the "bull-float" of the road builder. The state specifications allowed 1/16-inch variation in the surface of the deck in 10 feet. None were found on this job due to the well-built screed. 25.6.26

Construction Industry News

Calcium Chloride Association has moved to larger quarters at 2075 Penobscot Building, Detroit, Mich. This move was necessitated by the expanding activities of the Association and by recent increases in its staff. Members of the Association are the Columbia Alkali Corp., Dow Chemical Co., Michigan Alkali Co., and Solvay Process Co. Recent additions to the staff include B. C. Tiney, formerly Maintenance Engineer of the Michigan State Highway Department and Chairman of the Maintenance Committee of the Highway Research Board, who has been named Chief Engineer of the Association and Fred Burggraf, formerly a research engineer for the Highway Research Board, who has been appointed Soils Engineer. Ray A. Giddings is Secretary of the Association.

American Sealdrok Corp., 43 E. Ohio St., Chicago, Ill., has recently been incorporated as a subsidiary of the American Asphalt Paint Co. Its President, H. M. Stafford, was divisional director of the Barber Asphalt Co. for the western territory for ten years and personally handled the research work and patented process on which Sealdrok is based.

Conveying Weigher Co., Passaic, N. J., has lost through death its Chief Engineer, A. F. Crank, who with the late B. M. Mitchell developed belt conveyor systems for pouring concrete in dams.

Diamond Iron Works, Inc., Minneapolis, Minn., has announced the appointment of Kellogg & Tree, 300 Madison Ave., New York City, as its exclusive sales agents in the New England states, New York and New Jersey for complete equipment for sand and gravel pits, including crushing and washing machines and a portable crushing and screening plant in various capacities, as well as crushers for road building, a road surfacer attachment, and oil, asphalt and tar heaters for states, counties, municipalities and contractors.

Link-Belt Co., Chicago, Ill., has recently acquired an exclusive license to build and lease T & M tunnel shields for the construction of inside diameter tunnels from 4 to 8 feet inclusive. The headquarters for this new activity of this company will be located at 2045 W. Hunting Park Ave., Philadelphia, Penna., and the present staff of the Tunnel & Mine Machinery Co., owners of the patents, will assist the Link-Belt staff on engineering and sales promotion.

Malcolm Pirnie, Civil Engineer, 25 W. 43rd St., New York City, on January 10 resigned as Deputy Administrator of the NRA to return to New York to resume his engineering practice. He was engaged in the codification of the Construction Industry.

The Johnson-March Corp., manufacturer of the Hunt Process, an asphaltic compound for curing concrete; Ritecure, a new transparent curing medium; and McEverlast protective coatings for pipe lines, has announced the appointment of Gloster P. Hevenor as Vice President and General Manager. This company has recently moved its offices from Long Island City to the Vanderbilt-Concourse Bldg., 52 Vanderbilt Ave., New York City.

Reo Motor Car Co., Lansing, Mich., has announced the appointment of A. L. Struble as Sales Manager of the Truck Division, to succeed Carl Parker who has resigned. Mr. Struble is well known in the truck field and has been associated with the Reo company for three years.

The Jeffrey Mfg. Co., Columbus, Ohio, has opened offices in the Carew Tower Bldg., Cincinnati, Ohio, and in the Rockefeller Bldg., Cleveland, Ohio, to more effectively serve the surrounding territories. Lyle Martin will be at the Cincinnati Office and G. D. Francisco and J. R. Warren at the Cleveland Office.

Distributors Wanted—Manufacturer of line of pavers and mixers desires distributor representatives of good credit rating and not handling competitive equipment in various sections of the United States. Distributors who can qualify and who are interested should write to Box E 102, CONTRACTORS AND ENGINEERS MONTHLY, 470 Fourth Ave., New York City.

A MEETING OF A.E.D. MEMBERS WITH MANUFACTURERS WAS HELD IN CHICAGO ON JANUARY 22, 1934

The Mixer Manufacturers' Code, the Shovel, Dragline and Crane Industry Code, the Bin and Batcher Manufacturers' Code and other Codes were interpreted by representatives of the manufacturers and discussed informally by both distributors and manufacturers to their mutual benefit. E. K. Hurst discussed the Code of the Construction Machinery Distributing Trade, showing how it was intended to interlock with the sales provisions of the various manufacturers codes. The membership of the Associated Equipment Distributors is now 124 distributor members and 36 allied manufacturer members.

The New Wisconsin Air-Cooled 4-Cylinder Industrial Motor

A New Air-Cooled Industrial Motor

THE success of the Wisconsin single-cylinder heavy-duty, air-cooled engine has caused the Wisconsin Motor Corp., Milwaukee, Wis., to bring out a heavy-duty four-cylinder air-cooled engine of 6 to 16-hp capacity, known as Model AC4. It has a 2⅝-inch bore and 3¼-inch stroke with a piston displacement of 70.35 cubic inches. The engine develops 10 horsepower at 1,350 rpm., 12 horsepower at 1,600 and peaks at 16 hp at 2,600 rpm.

An outstanding feature of this model is its light weight, the engine with accessories weighing only 215 pounds and the complete unit with house, gas tank, and accessories weighs only 265 pounds. The overall length of the complete unit is 20¼ inches. It has been particularly designed for the heavy-duty service of the industrial, agricultural and automotive fields, and because light weight is very essential, materials of high tensile strength are employed to keep the weight down.

A New Cold-Lay Asphalt Paving Mixture

A COLD-LAY asphalt paving mixture known as Sealdrok which has water-proofed mineral aggregate and is produced by an asphalt mixing plant containing many innovations of plant design has been announced by the American Sealdrok Corp., 43 E. Ohio St., Chicago, Ill. Inasmuch as approximately 94 per cent of all asphalt paving mixtures is mineral aggregate, this process provides that the aggregate be thoroughly dried and graded as to the proper sizes. It is then impregnated with a waterproofing compound having an asphalt base leaving each particle of the aggregate sealed with a film of pure bitumen. After this it is treated with Texaco asphalt cement of 60-70 penetration.

The asphalt mixing plant is of the continuous mixing type, is entirely automatic and is set to predetermined capacities from 20 tons an hour to as high as 40 tons an hour. All of the materials are accurately measured and controlled to produce a uniform mixture. The plant requires but three laborers for its operation, thus reducing production costs. The drier arrangement for the mineral aggregate both dries and cools the aggregate in one chamber, eliminating any danger of hot aggregate destroying the cementing value of the asphalt. It requires three full minutes for the mixture to pass through the mixer, thereby insuring thorough intermingling and coating of the mineral aggregate with the asphalt cement.

Aggregate may be shipped and stockpiled for future use after impregnating with waterproofing compound and the asphalt coating may be applied locally using the usual concrete mixer or by penetration. The average contractor does not have adequate equipment or skilled labor for the proper conditioning of mineral aggregates on the job and the Sealdrok mixing plant installed in a quarry or gravel pit makes it possible to supply him with a waterproofed aggregate.

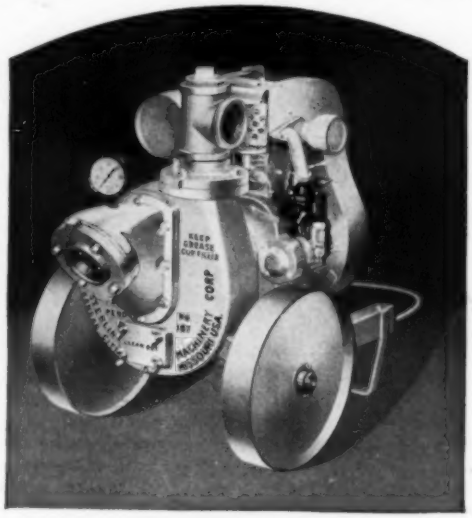
Waterproof mineral aggregate provides an economical material for building and widening road shoulders furnishing a dustless and waterproofed shoulder preventing the water from running underneath the concrete slab. The Sealdrok process also includes the treatment of stone dust and screenings, which are now more or less a waste product at quarries. This treated material may be stored in convenient stockpiles for future use and may be utilized for covering macadam roadways and streets in place of oil, for the covering of parking areas to prevent dust, under sidewalks in place of cinders and many other uses. Sand may be treated and used for the same purposes.

Self Priming Without Valves

A RADICAL improvement in self-priming centrifugal pumps, providing quick priming and controlling recirculation without the use of valves, has been announced by Sterling Machinery Corp., 411-13 Southwest Blvd., Kansas City, Mo., in its new line of 2, 2½, 3, 4 and 6-inch centrifugal pumps. A removable check valve independent of the automatic priming device is built into the suction connection to hold the prime in suction line. A vacuum gage for checking the suction lift and priming action are standard equipment. A bail for lowering into excavations and an improved steel strainer are also provided.

The new grease seal is a great improvement over earlier types. No valves are used in the discharge line to control recirculation of the water after the pump is primed. The elimination of this valve to control recirculation has been taken care of by the use of the centrifugal force of the water revolving in the outer chamber of the pump.

All suction and discharge connections are fitted with flanges making it easy to connect and disconnect the suction and discharge hoses or pipes. The automatic grease feed fitted to the grease seal of the pump uses air pressure to feed grease to the seal continuously and it is extremely simple in operation and should not be confused with a self-feeding grease cup.



The New Sterling Self-Priming Pump

One of six "Caterpillar" Diesel Seventy-Fives that slashed costs for A. Guthrie and Co. on the Mississippi Levee, averaging 1000 yds. per tractor perday on hauls from 1000 feet up.

"I'M CONVERTED to the 'CATERPILLAR' DIESEL"

—says a Southern California contractor—and no wonder, with a fuel saving better than $150 a month.

It is *economy* that has put hundreds of "Caterpillar" Diesel Tractors to work on outdoor jobs everywhere. Economy of low-priced Diesel fuels. Economy of low fuel consumption.

Economy and power and sturdy dependability and simplicity of design.

"Caterpillar" Diesel Tractors are built in three sizes, and the engines that power them are available also for stationary and portable uses. Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

▲ Carving a new road out of the mountainside in the Santa Barbara National Forest, this "Caterpillar" Diesel Fifty uses only 60c worth of fuel per 8-hour shift.

▶ At 11,000-foot altitude near Aspen, Colorado, this "Caterpillar" Diesel Fifty is saving power costs in the construction of a diversion tunnel.

The Euclid Front-End Loader Mounted on a Cletrac 20

A Tractor-Mounted Front-End Loader

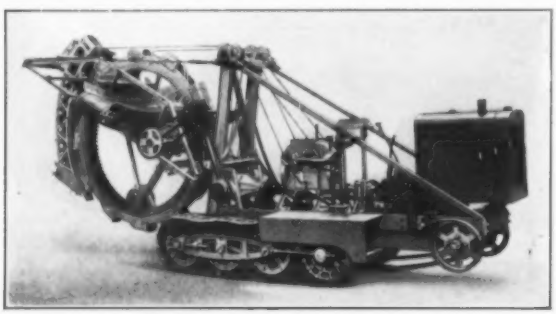
A COMPACT front-end loader which can be easily and quickly attached to a standard or hillside model Cletrac 20, 30 or 35 without altering the tractor has been announced by the Euclid Road Machinery Co., Cleveland, Ohio. The design of this front-end loader utilizes the operating mechanism on the rear of the tractor as a counterbalance. This is claimed to give better balance and load distribution on the tractor and a better balanced unit when carrying a load.

The unit is hydraulically-operated and is controlled by a single lever. The bucket automatically stops at its highest and lewest position and may be dumped at any desired height. The tractor may be used for other work with the loader attached, or by the removal of two bolts on the lifter arms and the collars on the cross shaft the tractor can be quickly backed out of the bucket and push arms.

The Euclid front-end loader is designed to handle all kinds of bulk material and is suitable for many types of excavation, such as digging or cleaning ditches, cutting light grades and handling sand, gravel or snow.

A New Service Ditcher

A NEW unit has recently been added to the line of ditching and trenching machines made by the Buckeye Traction Ditcher Co., Findlay, Ohio. This new Model 11, which is the smallest of the Buckeye line, is a service ditcher, designed for use in cramped quarters, in narrow alleys, close to curbs and anywhere that laterals or other small trenches up to 22 inches in width and 5½ feet deep are required.



The New Small Buckeye Crawler-Mounted Wheel-Type Ditcher and Trencher

The overall width of the machine is 52 inches and it is mounted on full length Alligator traction units of Buckeye design and may be turned completely around in its own length. The most important feature of this machine is its rotary digging wheel, the strength and operation of which are claimed to produce some remarkable footage records. When soil conditions are favorable, the smaller sizes of shallow trench may be dug at speeds up to 27 feet per minute. Through two selective four-speed transmissions, sixteen different gear ratios are available. Further regulation of speed through the manually-operated engine governor give a large number of digging speeds ranging from 8 inches per minute up. At the slower digging speeds, this machine is claimed to cut its way through the most difficult of hard soils. A crumbler and leveler at the rear of the cutting wheel are designed to insure a clean trench.

The Model 11 is available in three different bucket widths, cutting trenches 11½ to 14½ inches, 14½ to 18 inches and 18 inches to 22 inches. The buckets may be furnished for either rounding or square-bottom ditches.

A New 12-Ton Locomotive Powered With a Caterpillar Diesel Engine

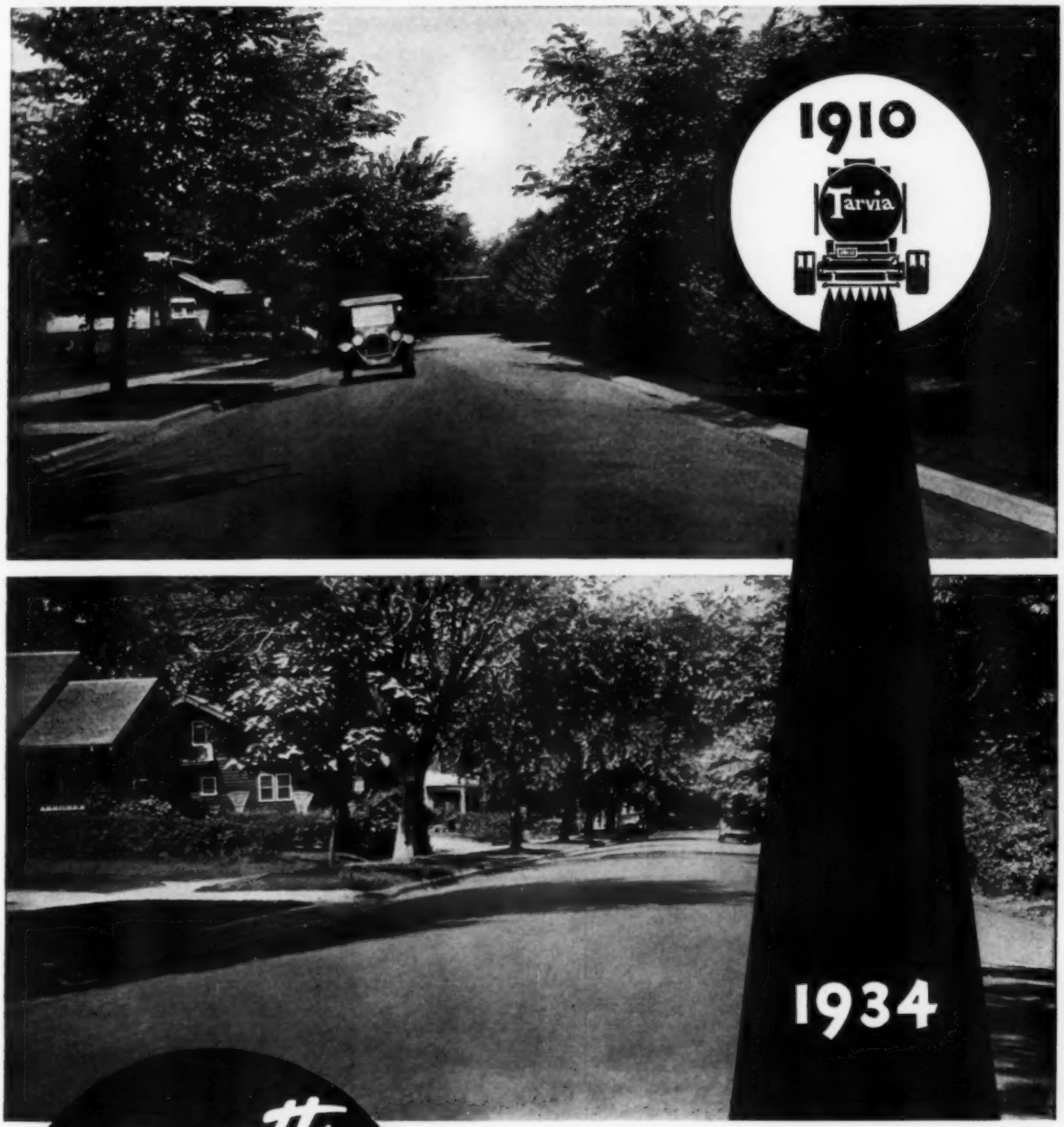
Two New Diesel Locomotives

TWO new Plymouth diesel locomotives, one an 8-ton and the other a 12-ton, both of which are equipped with Caterpillar diesel engines, have recently been announced by the Fate-Root-Heath Co., Plymouth, Ohio. These two units have several new features. One of these is the one-piece frame built of steel plates. All joints of the frame are solidly welded together and are thoroughly braced against all strains to which a locomotive is subjected. The clutch is of the dry-plate type and is ruggedly and powerfully constructed. It can easily be removed for servicing without interference with the engine or transmission.

There are four speeds forward and four reverse and all gears and shafting are constructed of special heat-treated alloy steel supported on ball and roller bearings. As in the case of all Plymouth locomotives, a heavy-duty sliding gear transmission is standard equipment. Another feature is the semi-elliptic cross-equalized spring suspension, which is located outside the frame for easy accessibility and inspection and makes it possible for the locomotive to travel smoothly over rough and uneven tracks at full speed without danger of derailment.

The 8-ton model is powered with a Caterpillar 4-cylinder diesel engine which develops 66 hp at 850 rpm. The 12-ton unit is equipped with a 6-cylinder Caterpillar diesel engine developing 102 hp at 820 rpm.

Marston Avenue, Madison, Wisconsin. Tarvia-built in 1910, the year Glenn Curtiss flew from Albany to New York to win a $10,000 prize. Upper photo was taken in 1920; lower photo shows the road today. After 24 years of ever-increasing traffic, it is in first-class condition.



Barrett Tarvia
GOOD ROADS AT LOW COST

Tarvia roads are as permanent as any surfaced roads can be. They are uniformly good—smooth, easy-riding, skid-safe. They may be built with inexperienced labor, and they cost less per mile and less per year of service. Tarvia service records, maintained over a period of thirty years, prove it. The Tarvia field man is competent to assist you with any highway problem. 'Phone, wire or write.

THE BARRETT COMPANY

New York	Chicago	Philadelphia	Toledo	Boston
St. Louis	Lebanon	Minneapolis	Cleveland	Milwaukee
Detroit	Baltimore	Columbus	Youngstown	Birmingham
Buffalo	Providence	Syracuse	Hartford	Cincinnati
	Bethlehem	Rochester	Portland, Me.	

THE BARRETT COMPANY, LTD. Montreal Toronto Winnipeg Vancouver

An Athey 8-Yard Wagon Mounted on an Anderson Pneumatic-Tired Chassis Working on a Levee in Mississippi

A Pneumatic-Tired Chassis for Dirt-Moving Wagons

A NEW chassis for large dirt-moving trail wagons of the crawler type which is equipped with pneumatic-tired wheels and which is designed to meet the varied hauling conditions encountered in all new construction, to operate efficiently in sand, muck or on paved streets, on a 200-foot or a 2-mile haul at speeds of 2 up to 20 miles an hour, has been announced by the E. H. Anderson Equipment Co., 3918 So. Wabash Ave., Chicago, Ill.

It is claimed that this easy-rolling chassis will reduce the draft of the wagons with material savings in fuel costs, as well as reducing the weight of the wagons as much as 3,000 pounds, which also reduces fuel costs. Wagons mounted on Anderson chassis are easy-turning units, as they will pivot on either front wheel. The two rear wheels castor so that there is no strain on the chassis or wagon when turning. A special device controlled by the tractor driver locks the castor wheels for backing. This chassis can be fitted to any crawler wagon in a short time. Various chassis and tires are available for different size wagons.

A New Pipe-Line Plow

A PLOW designed especially to facilitate the laying of oil and gas-lines but which is applicable to any shallow pipe-laying job is manufactured by R. G. Le Tourneau, Inc., Wilson Way at Roosevelt, Stockton, Calif. This pipe-line plow consists of two plow shares, both throwing furrows to the center, an elevating moldboard, and a side wing or blade for disposing of the earth, the whole mounted on a wheeled frame in such a manner that the depth of the furrow taken can be controlled by a cable from the Le Tourneau power control unit mounted on the tractor which draws the plow.

This new tool will dig a 30-inch trench in three cuts, depositing the earth taken out about 6 feet to the right of the center line in an easy position for backfilling with a bulldozer or by hand. The position of the side wing is variable and the wing can be controlled independent of the plow shares. The plow leaves the side walls straight and unbroken and is readily handled by a 75-hp tractor in high gear.

The Le Tourneau Pipe Line Plow

Hydraulic Control for Scrapers

THE Crescent hydraulic scraper, made by Sauerman Bros., Inc., 464 So. Clinton St., Chicago, Ill., has a new feature in a unique form of hydraulic control which is claimed to be an improvement over previous schemes for the hydraulic operation of a scraper with a tractor, and which also is designed to increase the effectiveness of the scraper in penetrating hard earth materials.

This Sauerman hydraulic control provides a crowding action for digging, in addition to the usual dumping and holding operations. This crowding action requires a double acting ram and a control valve with a single operating lever having five operating positions. The central or neutral position permits the oil to be circulated freely by the pump and the ram to be moved freely by the weight of the scraper. Moving the lever in one direction contracts the ram, and in the other direction, expands the ram, the first motion being used to dump the bucket and the second to crowd the digging action. The two outside positions are holding positions, which prevent travel of the ram in either direction and, at the same time, permit free circulation of the oil by the pump.

A Crescent Hydraulic Scraper, Drawn by a Tractor, Dumping a Load on a Spoil Pile

Because of the elliptical form of the cutting edge of this scraper, the crowding action raises the forward part of the cutting edge, with the result that the pull of the tractor is concentrated on a narrow portion at the back of the scraper, thereby facilitating the penetration of clay, hard-packed gravel and similar materials.

A New Light Dragline Bucket for Easy Digging

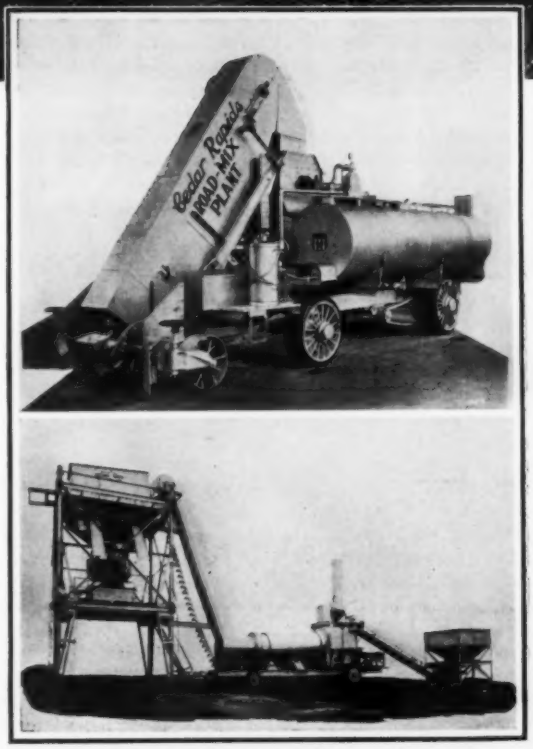
EXCAVATION is becoming more and more a matter of specialization. The all-purpose bucket is not used universally, for contractors are finding that light buckets can be used in easy digging and produce a higher output because every pound of weight that can be removed from a dragline bucket means a pound more of dirt which can be swung to the spoil bank. The Northwest Engineering Co., 28 E. Jackson Blvd., Chicago, Ill., has announced a new dragline bucket designed to increase working ranges and output in earth excavation. It is of light weight construction and has a wide mouth. It is built in three sizes, 54, 67½ and 81 cubic foot capacities struck measure. While of lighter weight and having a wider mouth, it embodies the standard heat-treated Northwest arch made of a heavy I-beam section capable of withstanding the shock of being dropped on the nose. The lip is of rolled alloy steel and both arch and lip are toughened by heat treating.

More Miles per Dollar

BUILT THE Cedar Rapids WAY

A section of highway in Arizona surfaced with a Cedar Rapids Traveling Plant.

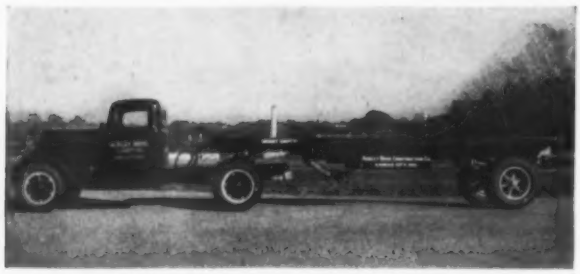
NOT only "more miles per dollar" but "more road per mile" if you use a Cedar Rapids Pre-Mix or Traveling Road Mix machine on your next black top job. Highway engineers and contractors have recognized the importance of "machine mix". It is the only way to avoid excessive maintenance costs. The lean and fat spots caused by uneven mixing bring about surface failures. The accurately controlled method of batching used on the Cedar Rapids machines eliminates these common faults so often found in other road mix methods. Cedar Rapids plants have mixed hundreds of miles of low cost roads in fourteen different states, every mile of which has been accepted. We will gladly furnish detailed information on both types of plants. Write for our latest bulletin.



Above: Latest model Cedar Rapids Traveling Plant.
Below: Cedar Rapids "Batch Type" Pre-Mix Plant.

Made by

Iowa Manufacturing Company
Cedar Rapids, Iowa



A Fruehauf Platform-Bed Semi-Trailer Recently Delivered to the Ackley Bros. Construction Co., Kansas City, Mo. This Unit, Which Is Powered by a Dodge 2-Ton Tractor-Truck, Is Used to Move Tractors, Road Graders and Similar Equipment.

A New Line of Vertical Compressors

DESIGNED to achieve greater savings in air compressor costs, a new line of vertical compressors has recently been announced by the Gardner-Denver Co., Quincy, Ill. It is claimed by the manufacturer that these new compressors deliver the same amount of air as horizontals of the same capacity, while the installation cost is two-thirds lower and maintenance costs are from 25 to 50 per cent less.

The inlet and discharge valves are cushioned, and are silent and durable. Extra large water jackets completely surround the cylinders and valves and a water-cooled intercooler saves power and increases volumetric efficiency by cooling the air between stages. The crankshafts are of large diameter forged steel, supported by three main bearings of the bronze-backed babbitt-lined full-circle type. There is pressure-feed lubrication to all bearings through drilled passages and a rotary oil pump assures constant and uniform oil pressure.

A New Lighter Crankless Diesel Engine

A CRANKLESS diesel engine, built horizontally and of unprecedented light weight and small size, has been announced by the Sterling Engine Co., 1252 Niagara St., Buffalo, N. Y. The revolutionary compact construction of the engine, which is obtained in part through the absence of crankshafts, camshafts, cylinder heads, valves and cylinder head gaskets, makes the power plant adaptable for many mobile and stationary uses. The engine is of 2-cycle design, and runs on the lowest grade of fuel oil.

Sterling engineers estimate a 75 per cent fuel cost saving in the new power plant over the ordinary gasoline engine. The overall dimensions of the Sterling diesel are comparable in size to a gasoline engine developing the same horsepower, with the added advantage of a much lower height. The weight per horsepower of the new diesel ranges from 13 to 20 pounds, dependent upon the size of the power unit as against the 50 to 80 pounds per horsepower in the conventional diesel.

The engine includes either 4 or 6 horizontal cylinders, each containing two opposed or reciprocating pistons, equivalent to a power plant of the eight or twelve-cylinder type by virtue of the Sterling 2-cycle design. Combustion is obtained by compressing the air between the heads of each pair of opposed pistons, and at the point of maximum pressure an injection of fuel is made and ignited by the heat of compression. The power generated by the pistons is transferred to inclined discs, which are virtually flywheels, mounted on a straight drive shaft at each end of the engine. The mechanical bearing units, which transfer the power from the reciprocating pistons to the rotating discs, involve exactly the same principle as that employed in the Michell or Kingsbury thrust bearings, used in most of the world's ships. These bearings, which have a universal mounting, are free to adapt themselves to the action of the inclined disc. In the engine's cycle or operation, intake and exhaust occur almost simultaneously following the explosion in one revolution, as compared with two revolutions required in a 4-cycle engine.

A piston-type scavenging air blower is used because pressure scavenging is necessary in 2-cycle diesel engines, and a piston type, valveless blower is particularly applicable to the design of the engine, without the use of additional or complicated operating mechanism. This Sterling blower has no poppet or automatic valves, nor connecting rods, nor crankshaft. Cylinder heads are automatically eliminated in this opposed-piston engine.

A New Model Tractor

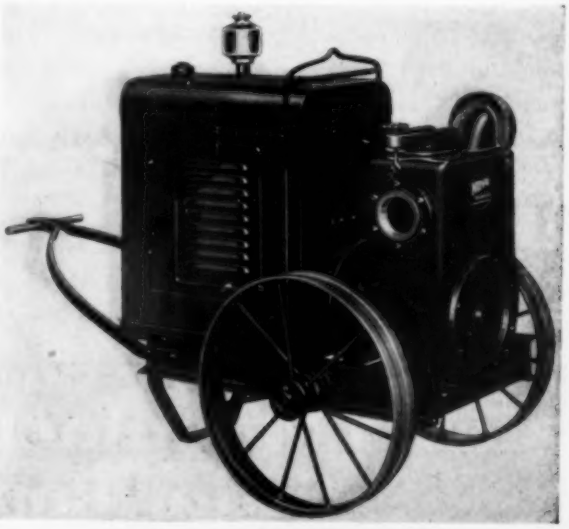
A NEW Twenty-Eight tractor has recently been announced by the Caterpillar Tractor Co., Peoria, Ill., to succeed the model Twenty-Five. The machine incorporates all the features of design and construction that have been characteristic of the Twenty-Five, plus increased power and weight.

The 4-cylinder valve-in-head engine has a bore and stroke of 4 3/16 x 5½ inches and develops a maximum of 30.49 hp at the drawbar and 37.47 hp at the belt. Ground contract, with standard tracks, is 1,251 square inches.

The Latest in Self-Priming Pumps for Contractors

THE earliest self-priming centrifugal pumps required many attachments, then came the recirculating principle of priming. Now Novo Engine Co., Lansing, Mich., announces the Injecto Prime in which the self-priming centrifugal pump uses no valves, floats, adjustments or packing glands and employs only two moving parts, the impeller and the impeller shaft. By this new principle the air is exhausted more rapidly from the suction line, by injecting the air into the recirculating water flowing at a high velocity. The result is a faster prime and a higher head.

This new line of Novo self primers is built in four sizes, 2, 3, 4 and 6-inch which give 10,000, 20,000, 40,000 and 90,000 gallons per hour, respectively.



The New Novo Injecto-Prime Pump

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